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THE ANNALS
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ZOOLOGY, BOTANY, AND GEOLOGY.

BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LONDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.'

CONDUCTED BY
WILLIAM CARRUTHERS, Ph.D., F.R.S., F.L.S., F.G.S.,
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AND
WILLIAM FRANCIS, F.L.S.

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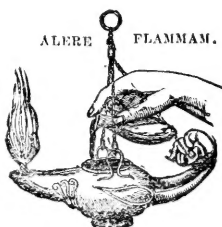
"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quel que soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

. The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.

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AND
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[EIGHTH SERIES.]

“..... per litora spargite muscum,
Naiades, et circum vitreos considite fontes:
Pollice virgineo teneros hic carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchyliis succo.”
N. Parthenii Giannettusi, Eol. 1.

No. 103. JULY 1916.

I.—*The British Fishes of the Subfamily Clupeinæ and Related Species in other Seas.* By C. TATE REGAN, M.A.

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[Plates I.–III.]

I. SYSTEMATIC.

IN the ‘Catalogue of Fishes’ Günther included in the genus *Clupea* all the Clupeidæ with mouth terminal, teeth minute or absent, a complete mid-ventral series of scutes, and the anal fin of moderate length, with less than 30 rays.

This conception of a large, varied, and cosmopolitan genus is not well adapted for modern work on the relationships and distribution of the species, and it is generally recognized that the genus *Clupea* should be split up into several. But there is no general agreement as to the limits and contents of these genera, nor can there be until a thorough revision of the whole group has been made.

The present paper is a systematic revision of the three genera—*Clupea*, *Alosa*, and *Sardina*—represented on the coasts of Britain. In his memoir on the Clupeoids of the Caspian Sea (Ann. & Mag. Nat. Hist. (2) xi. 1913, pp. 472–480), L. Berg, Professor of Ichthyology in the Moscow

Ann. & Mag. N. Hist. Ser. 8. Vol. xviii. 1

Academy of Agriculture, has defined the genera that occur in Russian seas. It will be seen that I differ from him in uniting *Spratella* with *Clupea* and in separating *Sardina* from *Sardinella*; the last-named includes a number of tropical and subtropical species that differ from the sardines in more than one character, notably in that the operculum has a single groove near its anterior edge instead of several radiating grooves.

CLUPEA, Linn.

Elongate, compressed. Maxillary extending to below anterior part or middle of eye; lower jaw projecting; upper not notched; teeth minute. Operculum smooth. Dorsal fin of 15 to 21 rays; origin nearly equidistant from end of snout and base of caudal. Anal of 14 to 21 rays; two last rays not enlarged. Caudal forked; no enlarged caudal scales. Pelvics 7- to 10-rayed, inserted below or in advance of middle of dorsal. 44 to 65 scales in a longitudinal and 12 to 16 in a transverse series. Vertebrae 46 to 59.

In his classical research Heincke has discussed at length the variation and specific characters of the herring and sprat as found in the North Sea and the Baltic, and has summarized his conclusions on p. 59 of his second report (Viert. Ber. Comm. Unters. Meere, Kiel, 1882).

Some authors regard the sprat as the type of a genus, *Spratella*, distinct from *Clupea*, the principal difference being the absence of vomerine teeth. It is here shown that three closely related species from the Southern Hemisphere, which resemble the sprat rather than the herring in the number of fin-rays, scales, vertebrae, and gill-rakers, and in the form of the opercular bones, approach the herring in having the pelvic fins 8-rayed and the maxillary longer than in the sprat. Moreover, one of them, from Stewart Island, has the dentition of the herring, and another, from Magellan and the Falklands, has the ventral scutes weakly keeled, the vertebrae in increased number, and the pelvic fins often inserted a little behind the vertical from the origin of the dorsal fin, all characters of *C. harengus*.

It would be of considerable interest to ascertain whether these southern species show more resemblance to *C. harengus* or to *C. sprattus* in breeding-habits and structure of eggs.

There are some little fishes from the Black and Caspian Seas, three or four species in all, that bear a considerable resemblance to the sprat. Berg refers them to the genus *Harengula*, Val., which, according to his diagnosis, differs

from *Spratella* only in having the dorsal fin a little farther forward and the pelvic fins a little farther back. The only species of this group that I have seen (*Clupea delicatula*, Nordm.) differs from *Clupea* in the structure of the anal fin, which has the third last ray shorter than the one preceding it and the last two rays enlarged, almost forming separate finlets, just as in *Sardina* and *Sardinella*. This is an important character, and, in my opinion, shows that these little fishes are not at all closely related to *Clupea sprattus*, and do not belong to the genus *Clupea* as restricted above.

Synopsis of the Species.

- I. Pelvic fins 9- (rarely 8- or 10-) rayed, inserted behind vertical from origin of dorsal; præoperculum as broad as operculum; vomer toothed. Dorsal 17-21. Anal 14-20. Vertebrae 50-59. Gill-rakers on lower part of anterior arch, in adult, 40-51.

Ventral scutes keeled both in front of and behind pelvic fins 1. *harengus*.
 Ventral scutes in front of pelvic fins not keeled 2. *pallasii*.

- II. Pelvic fins inserted nearly in vertical from origin of dorsal; operculum broader than præoperculum. Dorsal 15-19. Anal 17-21. Vertebrae 46-51. Gill-rakers on lower part of anterior arch, in adult, 34-41.

A. Pelvic fins 8-rayed.

Vomer toothless; vertebrae 49-51 3. *fuegensis*.
 Vomer toothless; vertebrae 46 4. *bassensis*.
 Vomer toothed 5. *holodon*.

B. Pelvic fins 7-rayed; vomer toothless 6. *sprattus*.

1. *Clupea harengus*.

Clupea harengus, Linn. Syst. Nat. ed. 10, p. 317 (1758); Günth. Cat. Fish. vii. p. 415 (1868); Day, Fish. Britain, ii. p. 208, pl. cxxxviii. fig. 2 (1884); Smitt, Scandinavian Fish. p. 954, pl. xliii. fig. 1, & xlv. fig. 1 (1895); Jord. & Everm. Bull. U.S. Nat. Mus. xlvii. 1896, p. 421.

Depth of body from less than 4 to more than 5 times in the length, length of head $3\frac{1}{2}$ (young) to $4\frac{1}{2}$. Snout as long as or longer than diameter of eye, which is $3\frac{1}{2}$ to $4\frac{1}{2}$ in the length of head; maxillary extending nearly to below middle of eye, or sometimes beyond. An elongate-ovate patch of teeth on the vomer. 44 to 51 gill-rakers on lower part of anterior arch. Præoperculum nearly or quite as broad as operculum, which is narrower than diameter of eye. 55 to 65 scales in a longitudinal and 14 to 16 in a transverse series. Ventral scutes, except sometimes a few anterior ones, all distinctly keeled; 12 to 20 between pelvic fins and anus. Dorsal 17 to 21;

origin equidistant from end of snout and base of caudal or a little nearer the former. Anal 14 to 20. Pelvics 9- (8- to 10-) rayed, inserted below anterior part or middle of dorsal. Vertebrae 51 to 59 (54 to 59 in the few examples that I have examined). Silvery; back greenish.

Northern Europe and Iceland to New York and the Bay of Biscay.

Here described from numerous examples up to 400 mm. long.

2. *Clupea pallasii*.

Clupea pallasii, Cuv. & Val. Hist. Nat. Poiss. xx. p. 253 (1847); Jord. & Everm. Bull. U.S. Nat. Mus. xlvii. 1896, p. 422.

Clupea mirabilis, Girard, Proc. Ac. Philad. 1854, p. 138; Günth. Cat. Fish. vii. p. 418 (1868).

Closely related to *C. harengus*, differing especially in that the scutes in front of the pelvic fins are not keeled. 10 to 13 keeled scutes between pelvic fins and anus. Dorsal 18 to 19. Anal 14 to 18. 40 to 48 gill-rakers on lower part of anterior arch. 53 to 58 scales in a longitudinal series. Vertebrae 50 to 53 (50, 51, 52, 53 in four specimens examined).

North Pacific, from Bering Sea to San Diego, the middle of Hokkaido and Fusan.

Here described from ten examples, 160 to 300 mm. in total length, from Alaska and California.

3. *Clupea fuegensis*.

Clupea fuegensis, Jenyns, Zool. 'Beagle' Fish. p. 133 (1842); Smitt, Bihang. Svensk. Vet.-Akad. xxiv. 1898, iv. no. 5, p. 59, pl. v. fig. 41; Regan, Trans. R. Soc. Edinburgh, xlix. 1913, p. 231.

Depth of body 4 to 5 in the length, length of head 4 to $4\frac{1}{2}$. Snout as long as or a little longer than diameter of eye, which is nearly 4 in the length of head; maxillary extending nearly or quite to below middle of eye. An elongate patch of minute teeth on tongue; usually a series on palatines; vomer toothless. 38 to 40 gill-rakers on lower part of anterior arch. Præoperculum narrower than operculum, which is as broad as diameter of eye. About 50 scales in a longitudinal and 14 in a transverse series; ventral scutes feebly keeled and not sharply pointed, 22 to 25 + 10 to 13. Dorsal 16 to 18. Anal 17 to 20. Pelvics 8-rayed, inserted in or a little behind the vertical from origin of dorsal, rarely a little in advance of it. Vertebrae 49 to 51.

Magellan; Falklands.

Several examples, 140-170 mm. in total length, from the Falklands.

4. *Clupea bassensis*.

Clupea bassensis, McCulloch, Biol. Res. 'Endeavour,' i. 1911, p. 16, pl. iv. fig. 2.

Scarcely distinct from *C. fuegensis*, but vertebrae fewer (46) and scutes more strongly keeled. Scales 46 to 48 in a longitudinal, 12 to 14 in a transverse series. Pelvic fins inserted a little in advance of vertical from origin of dorsal.

South Australia and Tasmania.

Two examples, 110 and 130 mm. in total length, from Hobart.

5. *Clupea holodon*, sp. n.

Depth of body $4\frac{1}{4}$ in the length, length of head $4\frac{1}{4}$. Snout a little longer than diameter of eye, which is nearly 4 in the length of head; maxillary extending to below anterior $\frac{1}{3}$ of eye. An ovate patch of teeth on vomer, a single series on palatines, a broad-ovate patch on tongue. 36 gill-rakers on lower part of anterior arch. Præoperculum narrower than operculum, which is as broad as diameter of eye. About 48 scales in a longitudinal and 14 in a transverse series; ventral scutes keeled and pointed, 21+12. Dorsal 17. Anal 18. Pelvics 8-rayed, inserted below origin of dorsal.

Stewart Island, New Zealand.

A single example, 122 mm. in total length, from Stewart Island, presented in 1889 by C. Traill, Esq.

6. *Clupea sprattus*.

Clupea sprattus, Linn. Syst. Nat. ed. 10, p. 318 (1758); Günth. Cat. Fish. vii. p. 419 (1868); Day, Fish. Britain, ii. p. 231, pl. cxxxix. fig. 2 (1884); Smitt, Scandinavian Fish. p. 974 (1895).

Meletta phalerica (Risso), Moreau, Poiss. de France, iii. p. 445 (1881).

Meletta vulgaris, Moreau, t. c. p. 447.

Clupea subina, Antipa, Denkschr. Akad. Wien, lxxviii. 1906, p. 38, pl. iii. figs. 1-6.

Depth of body $3\frac{1}{2}$ to $5\frac{1}{2}$ in length, length of head $3\frac{3}{4}$ (young) to $5\frac{1}{5}$. Snout as long as or a little longer than diameter of eye, which is $3\frac{1}{3}$ to $4\frac{1}{4}$ in the length of head. Maxillary extending to below anterior $\frac{1}{3}$ of eye. No teeth on vomer. 34 to 40 gill-rakers on lower part of anterior arch. Præoperculum narrower than operculum, which is as broad as diameter of eye. 44 to 50 scales in a longitudinal and 12 to 15 in a transverse series. Ventral scutes keeled and pointed; 9 to 13 between pelvic fins and anus. Dorsal 15 to 19;

origin a little nearer to base of caudal than to end of snout. Anal 17 to 21. Pelvics 7-rayed, inserted below or a little in advance of origin of dorsal. Vertebrae 46 to 49.

Western and Southern Europe, from Norway to the Black Sea.

Numerous examples up to 175 mm. in total length.

In specimens from the Black Sea, Dalmatia, and Nice I count respectively 48, 48, and 49 vertebrae.

ALOSA, Cuv., 1829.

Règne Animal, ed. 2, ii. p. 319.

Deep or elongate, compressed; abdomen sharp-edged. Mouth large, the maxillary extending to below posterior part of eye; lower jaw included; upper with median notch; teeth minute or absent, none on vomer. Operculum with grooves radiating towards suboperculum. Dorsal fin of 16 to 22 rays; origin nearer to end of snout than to base of caudal; a low basal sheath, not extending upwards on last ray. Anal of 18 to 27 rays; basal sheath low; two last rays not enlarged. Caudal forked; lobes scaly; a pair of enlarged scales on each side. Pelvics 9-rayed, inserted below anterior part of dorsal. 55 to 86 scales in a longitudinal and 16 to 26 in a transverse series; ventral scutes prominent, with strong keels ending posteriorly in sharp points. Vertebrae 52 to 59.

North Atlantic and Mediterranean.

Clupeonella, Kessler, with four species from the Black Sea and nine from the Caspian (Berg, Ann. & Mag. Nat. Hist. (8) xi. 1913, pp. 472-480), differs from *Alosa* in having three patches of teeth on the palate, borne by the vomer and palatine bones. The value of this character is somewhat discounted by the fact that two closely related species of *Clupea* (*C. bassensis* and *C. holodon*) scarcely differ except in this respect; also I find that in large adult specimens of *Clupeonella caspia* the palate is toothless. *Pomolobus*, Raf., with four species from the Atlantic coast of North America, is distinguished from *Alosa* principally by the prominent lower jaw, its tip not included within the upper.

The species of all three groups appear to be migratory, spawning in fresh water, and perhaps *Alosa* and *Clupeonella* should rank only as subgenera of *Pomolobus*.

It is generally recognized that there are two species of shad on the Atlantic coast of Europe—*A. alosa*, L., and *A. finta*, Cuv., the former differing from the latter especially in the more numerous gill-rakers, and also in the somewhat

deeper form, smaller scales, and longer anal fin. Hoek (Tijdschr. Nederl. Dierk. Vereen. (2) vi. 1900, pp. 212-240) has published the results of a detailed examination of a large number of examples of these two species from the Rhine; the characters given by him hold good for specimens of both species from the coasts of the British Isles and Portugal. But the material in the British Museum collection indicates that *A. alosa* may be replaced on the coasts of Morocco and Algeria by a form with fewer gill-rakers, and that in the same regions *A. finta* is represented by a race with the gill-rakers in slightly greater number, and in the Mediterranean by another race with fewer gill-rakers than the typical form; moreover, both these southern forms of *A. finta* have the body as deep as in *A. alosa*. *A. finta* has also given rise to non-migratory colonies, one in the Lakes of Killarney, a second in Lakes Maggiore and Lugano, and a third in Lake Garda. All these lacustrine races have the gill-rakers in increased number, but whereas the Killarney shad is deeper in form than the typical *A. finta*, the Italian ones are more slender than the migratory shad of the Mediterranean.

The problem of species and subspecies is a difficult one, and it is not pretended that the course here adopted has finally solved it.

Synopsis of the Species and Subspecies.*

I. 21 to 26 scales in a transverse series.

- 55-85 gill-rakers on lower part of anterior arch . . . 1. *alosa*.
45 gill-rakers on lower part of anterior arch . . . 2. *africana*.

II. 16-20 scales in a transverse series.

A. American.

- a. 60-70 gill-rakers on lower part of anterior arch.
3. *sapidissima*.
b. 40-50 gill-rakers on lower part of anterior arch.

- Depth $3-3\frac{1}{2}$ in the length 4. *alabamæ*.
Depth $3\frac{1}{2}-4\frac{1}{2}$ in the length 4 a. *alabamæ ohiensis*.

B. Eastern Atlantic and Mediterranean.

- 24-27 gill-rakers; depth $3\frac{2}{3}-4\frac{1}{4}$ 5. *finta*.
33 gill-rakers; depth 3 5 a. *finta killarnensis*.
29 gill-rakers; depth 3 5 b. *finta algeriensis*.
20-23 gill-rakers; depth $3-3\frac{3}{4}$ 5 c. *finta nilotica*.
30-34 gill-rakers; depth about $4-4\frac{1}{2}$ 5 d. *finta lacustris*.
36-40 or more gill-rakers; depth $4\frac{2}{3}$ 5 e. *finta gracilis*.

* This synopsis applies to specimens of 200 mm. or more. Smaller fishes have fewer gill-rakers and may be more slender.

1. *Alosa alosa*, Linn.

Clupea alosa (part.), Linn. Syst. Nat. ed. 10, p. 318 (1758).

Clupea alosa, Günth. Cat. Fish. vii. p. 433 (1868); Day, Fish. Britain, ii. p. 235, pl. cxl. (1884); Hoek, Tijdschr. Nederl. Dierk. Vereen. (2) vi. 1900, pp. 182-240.

Alosa vulgaris, Moreau, Poiss. de France, iii. p. 453 (1881).

Depth of body 3 to 4 in the length, length of head $3\frac{3}{4}$ to $4\frac{1}{2}$. Dorsal 18 to 21. Anal 22 to 27. 70 to 86 scales in a longitudinal and 22 to 26 in a transverse series. 55 to 85 gill-rakers on lower part of anterior arch.

Coast of Europe, from Norway to Portugal.

Eight specimens examined, 200-500 mm. in total length.

2. *Alosa africana*, sp. n.

Depth of body $3\frac{1}{2}$ in the length, length of head $3\frac{3}{4}$. 45 gill-rakers on lower part of anterior arch. Dorsal 19. Anal 25. 68 scales in a longitudinal and 22 in a transverse series.

A single specimen, 300 mm. in total length, from Algeria (*Playfair*).

A smaller example, 140 mm. from Mogadore, is very similar, but has only 33 gill-rakers on the lower part of the anterior arch (*A. alosa* of this size would have 40 to 50).

Günther (Cat. Fish. vii. p. 36) has described a fish of 470 mm., without locality, as a hybrid between *A. alosa* and *A. finta*. This is, perhaps, correct, as Hoek has shown that specimens with an intermediate number of gill-rakers occur in the Rhine. My material is insufficient for determining the characters that distinguish *A. africana* from *A. alosa* × *A. finta*; but the improbability that this hybrid should be represented in the collection of the British Museum by two African specimens and *A. alosa* by none from Africa is so great that I have but little doubt that these examples belong to a southern species standing in much the same relation to *A. alosa* that *A. alabamæ* does to *A. sapidissima*.

3. *Alosa sapidissima*, Wilson.

Alosa sapidissima, Jord. & Everm. Bull. U.S. Nat. Mus. xlvii. 1896, p. 427, fig. 191.

Depth of body 3 to $3\frac{1}{2}$ in the length, length of head $3\frac{3}{4}$ to $4\frac{1}{2}$. Dorsal 17 to 19. Anal 20 to 22. 55 to 62 scales in a longitudinal, 18 or 19 in a transverse series. 60 to 68 gill-rakers on lower part of anterior arch.

Atlantic coast of U.S.A.

Four specimens examined, 300-400 mm. in total length.

4. *Alosa alabamæ*, Jord. & Everm.

Alosa alabamæ, Jord. & Everm. Rep. U.S. Fish. Comm. 1895, p. 203;
Bull. U.S. Nat. Mus. xlvii. 1898, p. 2810, figs. 192, 192 a.

Differs from the preceding only in the fewer gill-rakers,
less than 50 on lower part of anterior arch.

Alabama River and Pensacola, Florida.

4 a. *Alosa alabamæ ohiensis*, Everm.

Alosa ohiensis, Evermann, Rep. U.S. Fish. Comm. 1901, p. 277, figs. 1, 2
(1902).

More slender than typical *A. alabamæ*, the depth $3\frac{1}{2}$ to $4\frac{1}{2}$
in the length. 43 to 49 gill-rakers on lower part of anterior
arch.

Total length 350–450 mm.

Mississippi.

5. *Alosa finta*, Cuv.

Clupea finta (part.), Cuv. Règne Anim. ed. 2, ii. p. 320 (1829);
Günth. Cat. Fish. vii. p. 435 (1868); Day, Fish. Britain, p. 236,
pl. cxli. (1884).

Alosa finta (part.), Moreau, Poiss. de France, iii. p. 456 (1881).

Depth of body $3\frac{2}{5}$ to $4\frac{1}{4}$ in the length, length of head $3\frac{3}{4}$
to $4\frac{1}{3}$. 24 to 27 gill-rakers on lower part of anterior arch.
Dorsal 16 to 20. Anal 19 to 23. 55 to 65 scales in a longi-
tudinal, 16 to 20 in a transverse series. Ventral scutes 20 to
23 + 13 to 16.

Atlantic coast of Europe.

Several specimens from Britain and Portugal, up to
380 mm. in total length.

5 a. *Alosa finta killarnensis*, subsp. n.

Depth of body 3 in the length, length of head 4. 33 gill-
rakers on lower part of anterior arch. Dorsal 17 to 19.
Anal 19 to 21. 55 to 60 scales in a longitudinal, 17 to 19
in a transverse series. Ventral scutes 21 to 22 + 15 to 16.
Silvery; back purplish; a dark humeral spot; a lateral
series of about seven vertically expanded dark spots running
from behind operculum towards posterior end of anal fin.

Killarney.

A specimen of 210 mm. taken in January 1912. Two
smaller examples, 155 mm. long, taken in November 1875,
have the depth of the body $3\frac{1}{2}$ in its length and 30 gill-rakers
on the lower part of the anterior arch.

5 b. *Alosa finta algeriensis*, subsp. n.

Depth of body 3 in the length, length of head 4. 29 gill-rakers on lower part of anterior arch. Dorsal 18. Anal 22. 58 scales in a longitudinal, 20 in a transverse series. Scutes 21 + 15.

A single specimen, 300 mm. in total length, from Algeria (*Playfair*). A young fish of 170 mm. from Mogadore has the depth $3\frac{2}{3}$ in the length and 24 gill-rakers on the lower part of the anterior arch; it seems more likely that it pertains to this race than to the typical *A. finta*.

5 c. *Alosa finta nilotica*, Geoffr.

Clupea nilotica, I. Geoffr. Descr. Egypte Poiss. p. 286, pl. x. fig. 1 (1827).

Clupea finta, Bouleng. Cat. Afr. Freshwater Fish. i. p. 154, fig. 123 (1909).

Depth of body 3 to $3\frac{3}{4}$ in the length, length of head $3\frac{2}{3}$ to $4\frac{2}{3}$. 20 to 23 gill-rakers on lower part of anterior arch. Dorsal 17 to 20. Anal 20 to 24. 55 to 63 scales in a longitudinal, 18 to 20 in a transverse series. Scutes 20 to 24 + 14 to 15.

Mediterranean.

Several examples, up to 420 mm. in total length, from Egypt, Constantinople, and the Adriatic. From Moreau's enumeration of the gill-rakers (Poiss. de France, iii. p. 456), it seems that this form occurs also on the Mediterranean coast of France. The two examples from Algeria listed by Boulenger are not of this subspecies—one has 29, the other 45 gill-rakers on the lower part of the anterior arch.

5 d. *Alosa finta lacustris*.

Alosa vulgaris, Pavesi, Pesci e Pesca Ticino, p. 54 (1872).

Alosa finta, var. *lacustris*, Fatio, Faune Vert. Suisse, v. p. 51 (1890).

Depth of body 4 to $4\frac{1}{2}$ in the length, length of head 4. 30 to 34 gill-rakers on lower part of anterior arch. 63 to 70 scales (? including some on base of caudal) in a longitudinal and 17 to 20 in a transverse series. Ventral scutes 38 to 41. Vertebrae 59.

Lakes Maggiore, Como, and Lugano.

Length 160–300 mm. or more.

5 e. *Alosa finta gracilis*, subsp. n.

Depth of body $4\frac{2}{3}$ in the length, length of head 4. 36 gill-rakers on lower part of anterior arch. Dorsal 17 to 19.

Anal 19 to 21. 55 to 60 scales in a longitudinal, 17 or 18 in a transverse series. Scutes 23 or 24 + 14 to 16. Silvery; back bluish.

Lake Garda.

Here described from a specimen of 150 mm.

Two others, 100 and 125 mm. long, have respectively 28 and 32 gill-rakers on the lower part of the anterior arch.

Pavesi ('Pesci e Pesca Ticino,' 1872) quotes Canestrini to the effect that there may be as many as 61 gill-rakers on the anterior arch (*i. e.* about 40 on the lower part); this form is said to attain a length of 400 mm., and it is probable that in specimens of that size the number of gill-rakers is still greater.

SARDINA, Antipa, 1906.

Denkschr. Akad. Wien, lxxiii. p. 54.

Chupanodon (part.), Lacép. Hist. Nat. Poiss. v. p. 468 (1803); Jordan & Evermann, Bull. U.S. Nat. Mus. xlvii. 1896, p. 423 (nec Jord. & Gilb. 1883).

Elongate, moderately compressed; abdomen not sharp-edged. Mouth moderate, the maxillary not extending beyond middle of eye; lower jaw not prominent; upper without or with slight median notch; teeth minute or absent, none on vomer. Eye with well-developed adipose lids. Operculum with grooves radiating towards suboperculum. Dorsal fin of 16 to 20 rays, highest anteriorly, in the middle of the length of the fish, its origin nearer to end of snout than to base of caudal; a scaly sheath at base extending to tip of last ray. Anal of 16 to 20 rays, low, depressible in a scaly sheath; two last rays enlarged. Caudal forked; on each side enlarged scales at the inner edge of the scaly part of each lobe. Pectorals scaly at base; pelvics 8-rayed, inserted below middle or posterior part of dorsal. About 54 scales in a longitudinal and 10 to 14 in a transverse series; ventral scutes keeled, but not projecting beyond the edges of the groove in which they lie. Vertebrae 50 to 53.

Synopsis of the Species and Subspecies.

- I. Scales unequal, the oblique rows alternately of larger and smaller scales, the former covering the latter, so that 30 or less are counted in a longitudinal series.

More than 60 gill-rakers on lower part of anterior arch

1. *pilchardus*.

Not more than 60 gill-rakers on lower part of anterior arch

1 a. *pilchardus sardina*.

II. Scales all exposed, about 54 in a longitudinal series.

Head $3\frac{1}{3}$ to 4 in length; maxillary nearly or quite reaching middle of eye, in adults; 70 (young) to 110 gill-rakers on lower part of anterior arch 2. *sagax*.

Head $3\frac{2}{3}$ to $4\frac{1}{2}$ in length; maxillary not reaching middle of eye; 60 (young) to 75 gill-rakers on lower part of anterior arch . 3. *neopilchardus*.

Authors who have described *Sardina pilchardus* from specimens that had lost their scales, and who have therefore counted the scale-pockets, have assigned to it more than 50 scales in a longitudinal series (*e.g.*, Günther, Antipa); others who have examined better-preserved material have counted 30 scales or less in a longitudinal series. The explanation of this is that the scales are unequal in size and the smaller ones are hidden by the larger; every oblique row that is visible conceals the row behind it, which is formed of smaller scales.

In some examples the scales in certain areas may be of equal size, or nearly so, and in rare cases nearly all the scales of one side may be equal and regularly arranged, as in the example described and figured by Day (P. Z. S. 1887, p. 129, pl. xv.) as a hybrid pilchard and herring. This is a typical *Sardina pilchardus*, except that on one side it is scaled almost as in *S. sagax*, *i. e.*, nearly all the scales are exposed and one can count more than 50 in a longitudinal series; but a few anterior scales on the upper part of the side have the *S. pilchardus* arrangement.

1. *Sardina pilchardus*.

Chupea pilchardus, Walbaum, Artedi Pisc. iii. p. 38 (1792); Günth. Cat. Fish. vii. p. 439 (1868); Day, Fish. Britain, ii. p. 224, pl. cxxxix. (1884).

Depth of body 4 to 5 in the length, length of head $3\frac{3}{4}$ to $4\frac{1}{2}$. Snout as long as or longer than diameter of eye, which is $3\frac{1}{2}$ to $4\frac{1}{2}$ in length of head; maxillary extending to below anterior $\frac{1}{4}$ or $\frac{1}{3}$ of eye, sometimes a little beyond; depth of cheek (from eye to anterior end of præoperculum) not greater than diameter of eye. 63 (young) to 88 gill-rakers on lower part of anterior arch. Scales unequal, the oblique rows alternately of larger and smaller scales, the former nearly or quite concealing the latter. \Vertebrae 52 or 53. Silvery or golden; back greenish or bluish; a dark humeral spot often followed by a series which may be invisible unless the scales be removed.

Atlantic coast of Europe from Portugal northward to the British Isles.

In examples from Cornwall, 180–220 mm. in total length, I count 69 to 88 gill-rakers on the lower part of the anterior branchial arch; in specimens from Santander and Coruña, 150–180 mm. long, I find 66 to 82, and in young fish of 110 mm. 63 and 65.

The Cornish specimens of 220 mm. are of about the size usually attained, but not infrequently examples of 250 mm. or more may be captured, and one of 350 mm. has been recorded.

1 a. *Sardina pilchardus sardina*.

Clupanodon sardina, Risso, Hist. Nat. Eur. Mérid. p. 451 (1826).

Clupea pilchardus, var. *sardina*, Günth. Cat. Fish. vii. p. 440 (1868).

Sardina dobrogica, Antipa, Denkschr. Akad. Wien, lxxiii. 1906, p. 42, pl. iii. figs. 7–11.

Distinguished from the typical form by the fewer gill-rakers, not more than 60 on the lower part of the anterior branchial arch.

South-western part of the Black Sea; Mediterranean; Atlantic coast of Morocco; Madeira; Canary Isles.

In specimens from Constantinople (140–150 mm.) I find 55 to 60 gill-rakers on the lower part of the anterior arch, from the Adriatic (110–180 mm.) 50 to 60, and from Madeira (175–180 mm.) 54 to 57.

180 mm. seems to be about the maximum size attained by this form.

2. *Sardina sagax*. (Pl. I. fig. 1.)

Clupea sagax, Jenyns, Zool. 'Beagle,' Fish. p. 134 (1842); Günth. Cat. Fish. vii. p. 443 (1868); Gilchrist, Marine Biol. Rep. S. Afr. i. p. 57, fig. (1913).

Clupea melanosticta, Schlegel, Faun. Japon. Poiss. p. 237, pl. cviii. fig. 3 (1846); Kishinouye, Journ. Imp. Fisheries Bureau, Tokyo, xiv. 1907, pp. 71, 94, pl. xvii.

Clupea ocellata, Pappé, Fish. Cape of Good Hope, p. 20 (1853).

Clupanodon caeruleus (Giard, 1854), Jordan & Evermann, Bull. U.S. Nat. Mus. xlvii. 1896, p. 423.

Depth of body 4 to 5 in the length, length of head $3\frac{1}{2}$ (young) to 4. Snout longer than diameter of eye, which is 4 to 5 in length of head; in adults maxillary extending nearly or quite to below middle of eye and depth of cheek (from eye to anterior end of præoperculum) greater than diameter of eye. 70 (young) to 110 gill-rakers on lower part of anterior arch. Scales normally arranged, becoming quite small towards the base of the caudal fin. Vertebrae 50 to 52.

Silvery or golden; back greenish or bluish; a small dark spot at base of each scale on back; often a series of larger spots running backwards from the shoulder.

Chile and Peru; Pacific coast of U.S.A. and Lower California; Japan; South Africa.

I have examined a fair series of examples: from Chile six, 125–290 mm. in length (to end of middle caudal rays); from California twelve, 150–260 mm.; from Japan more than twenty, 115–210 mm.; and from South Africa six, 160–210 mm. The specimen figured, 210 mm. long, is from South Africa.

I have counted the vertebræ in several, and I find in one from Chile 52; three from California 51, 52, 52; four from Japan 50, 50, 50, 51; and two from South Africa 51, 51.

In specimens from Chile (125–290 mm.) I count 75 to 110 gill-rakers on the lower part of the anterior branchial arch, from California (150–260 mm.) 80 to 100, from Japan (115–210 mm.) 70 to 100, from South Africa (160–210 mm.) 100 to 105.

It is not improbable that a statistical study of a large series of specimens would lead to the definition of the Japanese (*S. melanosticta*), Californian (*S. cærulea*), and South African (*S. ocellata*) pilchards as subspecies not fully identical with the typical *S. sagax* from Chile.

The close relationship of this species to *S. pilchardus* is shown not only by the structure of the adult fish, but the eggs and larvæ also are precisely similar (*vide* Kishinouye), and their growth, food, migrations, etc., are the same.

3. *Sardina neopilchardus*. (Pl. I. fig. 2.)

Clupea neopilchardus, Steind. Denkschr. Akad. Wien, xli. 1879, p. 12
Waite, Rec. Canterbury Mus. i. 1911, p. 158.

Chupanodon neopilchardus, Stead, Fishes of Australia, p. 28, fig. 10
(1906); Edible Fish. N.S. Wales, p. 25, pl. iv. (1908).

Closely related to *S. sagax*, differing as follows:—Length of head $3\frac{2}{3}$ (young) to $4\frac{1}{2}$ in the length of the fish. Maxillary extending to below anterior $\frac{1}{4}$ or $\frac{1}{3}$ of eye; depth of cheek not greater than diameter of eye, even in adults. 60 (young) to 75 gill-rakers on lower part of anterior arch.

Western, Southern, and Eastern Australia; New Zealand.

Twelve examples, 110–230 mm. in total length, from New South Wales and New Zealand; the largest specimen, from Wellington, is figured.

II. GEOGRAPHICAL DISTRIBUTION.

In the report on the 'Terra Nova' fishes I gave a general account of the distribution of Antarctic and Subantarctic fishes, and I came to the conclusion that to illustrate the distribution of coast-fishes south of the tropics three zones might be recognized—Antarctic, Subantarctic, and South Temperate; the northern boundaries of these are the mean annual surface-isotherms of 6° , 12° , and 20° C. respectively.

In the Northern Hemisphere the problem is more complicated, and it is more difficult to limit and define the zones of distribution; but, if we regard the isotherms of 12° and 20° C. as bounding the Temperate Zones both in the north and the south, we find that the genus *Sardina* may be described as inhabiting the North and South Temperate Zones, barely overstepping their limits (*cf.* map, Pl. II.).

Sardina is absent from the Western Atlantic and from China and the west of Corea; the reason for this is unknown, but in the Western North Atlantic the meeting of the Labrador Current and the Gulf Stream produce a sudden transition from subarctic to almost tropical conditions, and the absence of *Sardina* may be connected with this.

The wide distribution of this genus is of interest when the close relationship of the species, and especially the practical identity of the pilchards of South Africa, Japan, California, and Chile, is taken into consideration.

The species are not oceanic, but may be found 50 miles or more from land. The eggs are pelagic and the young fish swim at the surface, so that one can understand how a South American species may have reached New Zealand or South Africa; but the crossing of the Tropical Zone would be more difficult.

There is good evidence that in comparatively recent times the limits of the Temperate Zones have fluctuated considerably. To take only one example, the trout (*Salmo trutta*) of the Atlantic coast of Europe ranges southward as a marine fish to the Bay of Biscay, not much south of the normal northern limit of the pilchard (*Sardina pilchardus*). But the presence of a trout in the rivers of Morocco indicates that not long ago sea-trout ranged as far to the south as the pilchard does now, and at that time the ancestral pilchard may, perhaps, have extended into the area of the present Tropical Zone.

Fishes that descend to considerable depths are less likely than shallow-water species or surface-swimmers to find the Tropical Zone an impassable barrier. It is therefore of some interest to note that Day has written of *Sardina pilchardus*:—

"During the colder months of the year they are frequently found in the stomachs of large ground-fish that have been taken with ground-lines some distance from the shore"; whilst Kishinouye writes of *S. sagax*, "We are told by fishermen that the sardine is often found in the stomach of deep-sea fishes, such as mutsu (*Scombrops chilodipteroides*), gisu (*Pterothrissus gisu*), and tara (*Gadus brandti*)."

It does not seem likely that under present conditions there is any interchange between the different colonies of *Sardina sagax*, Chilean, Californian, Japanese, and South African; but under somewhat different conditions this may not have been the case—with a warmer northern climate *Sardina sagax* may have had a continuous range in the northern part of the Pacific. On the other hand, a contraction of the Tropical Zone on the Pacific coast of America may have permitted an interchange of Chilean and Californian pilchards migrating in moderately deep water. *S. neopilchardus* may have evolved from *S. sagax* in the seas of Australia and New Zealand, whilst the latter has persisted without such conspicuous modifications in the other parts of its range.

Alosa has a much more restricted distribution than *Sardina*, as it occurs only in the North Atlantic and the Mediterranean. Southwards it extends a short distance into the Tropical Zone and northwards it ranges in the summer months well into the Subarctic Zone.

The more restricted distribution and the greater tendency to form local races of *Alosa* as compared with *Sardina* are no doubt correlated with the biological difference between the two genera, that the shads breed in fresh water and the young live in the rivers for a year or two before migrating to the sea, whilst the pilchards are strictly marine and have pelagic eggs and young. The local forms with a most restricted distribution are, of course, the non-migratory lacustrine colonies, such as the shads of Killarney or of Lake Garda.

Clupea harengus of the North Atlantic is closely related to *C. pallasii* of the North Pacific. Both species extend into the Arctic Zone, but neither is found on the northern coasts of Asia or America; southwards they range throughout the Subarctic Zone, and somewhat overstep its southern boundary. There can be little doubt that under somewhat milder climatic conditions the ancestral herring ranged along the whole northern coast of Eurasia and, perhaps, of America; it is not surprising that the herrings, belonging to the colder northern seas, are not represented in the Southern Hemisphere.

Clupea sprattus, of Western and Southern Europe, has a more southerly distribution than *C. harengus*, but does not

range so far south as *Sardina pilchardus*; it is not represented on the Atlantic coast of North America nor in the North Pacific, but it is represented on the coasts of Patagonia, Tasmania, and Stewart Island respectively by three species that are more closely related to each other than either is to *C. sprattus*. The greater distinctness of the northern and southern species, as compared with *Sardina*, may be correlated with their greater remoteness and colder habitat.

III. BIOLOGY AND ECONOMICS.

Owing to their economic value the life-history of the European Clupeidæ has been extensively studied, especially in the North Sea. One need only mention the researches of Hjort and Lea on the herring, Sund on the sprat, and Hook on the shads. But a fact that may, perhaps, be emphasized is that the exotic species of *Sardina* resemble the European pilchard, not only in the structure of the adult fish, but in that of the eggs and larvæ, and also in their biology—growth, food, migrations, etc.,—and that the Australian and South African species could certainly be made use of in the same way as the European one.

I have examined the scales of a considerable number of specimens, with a view to testing whether their structure agrees with what is known as to the rate of growth; a complete examination of the scales of all the pilchards in the British Museum collection would not be worth the time expended on it, for to get a clear idea of the growth and age of the species in any one locality it would be necessary to examine large samples taken from different shoals throughout the year*.

Marion (Ann. Mus. Marseilles, iv. 1891, fasc. 1, pp. 99–108, fasc. 2, pp. 66–72) has shown that in the Mediterranean *Sardina pilchardus sardina* breeds from January to May, and that the earliest fry, hatched in March, may attain a length of as much as 120–140 mm. by the end of the year, whilst those hatched in June reach only 80–90 mm. in December. Scales of specimens from Trieste, Dalmatia, Barcelona, and Madeira bear this out, the first winter ring corresponding to a length of 100–140 mm. (Pl. III. figs. 1, 3, 7); the largest examples, 180 mm., have from 3 to 5 winter rings. A few examples from Constantinople indicate that the average rate

* In a recent paper (Arch. Zool. lii. 1913, pp. 305–341) Fage has published the results of investigations on the biology and scales of *S. pilchardus*.

of growth in the Black Sea may be slower and that a greater age may be attained; they measure 135–155 mm. in length, and their scales have 3 to 6 winter rings (Pl. III. figs. 8, 9).

According to Cunningham ('Marketable Marine Fishes,' p. 168) *Sardina pilchardus* breeds at the mouth of the Channel from June to October. It might, therefore, be expected that the first winter ring would be formed at a smaller size than in the Mediterranean race, and this proves to be the case; in the scales that I have seen it corresponds to a length of 90 to 110 mm. (Pl. III. figs. 2, 6); specimens 200–220 mm. long have from 5 to 8 winter rings. Scales of *S. pilchardus* from Santander and Coruña (Pl. III. figs. 4, 5) are essentially similar to those from Cornwall.

Kishinouye has given a most interesting account of the biology of the Japanese pilchard (*S. sagax*). According to him the breeding-season is from February to May, and the young fish may attain a length of more than 120 mm. by the end of the year and 150 mm. in the second year; this is confirmed by the scales that I have examined (Pl. III. figs. 10, 11), but not his conclusion that the maximum size of 250 mm. may be reached in four or five years. In other parts of its range the growth of *S. sagax* appears to be much the same as in Japan, and *S. neopilchardus* (Pl. III. fig. 12) is essentially similar.

The fact that the structure of the scales conforms so well to what is known of the rate of growth of the species may be regarded as confirming, if any confirmation were necessary, the soundness and accuracy of the methods used by Lea in his researches on the herring.

The fishes of the genus *Sardina* are of great economic value. *Sardina pilchardus* is the basis of the sardine industries of France and Portugal and the pilchard fishery of Cornwall. The Japanese, who rival the Norwegians in their utilization of the resources of the sea, regard *Sardina sagax* as their most important fish. According to Kishinouye it is appreciated as a nutritious and palatable food, and enormous quantities are pressed for oil or dried for manure; also the immature fish are tinned in oil and exported as "Japanese sardines." In California the same species is canned and sold as "Californian pilchards."

Hitherto very little use appears to have been made of the pilchards of South Africa, Australia, and New Zealand, although they are very abundant; perhaps in the future sardine industries will become established in those parts of the British Empire.

EXPLANATION OF THE PLATES.

PLATE I.

Fig. 1. *Sardina sagax*, S. Africa, 210 mm.

Fig. 2. *Sardina neopilchardus*, New Zealand, 230 mm.

PLATE II.

Distribution of *Sardina*. The mean annual surface-isotherms of 6°, 12°, and 20° C. are shown. //////////////, *S. pilchardus*; \\\\\\\\\\\, *S. pilchardus sardina*; ≡≡≡, *S. sagax*; |||||||||, *S. neopilchardus*.

PLATE III.

Diagrams of scales of *Sardina*.

Fig. 1. *S. pilchardus sardina*, Barcelona, 140 mm.

Fig. 2. *S. pilchardus*, Cornwall, 200 mm. (specimen figured by Day, P. Z. S. 1887, pl. xv.).

Fig. 3. *S. pilchardus sardina*, Trieste, 140 mm.

Fig. 4. *S. pilchardus*, Santander, 175 mm.

Fig. 5. *S. pilchardus*, Coruña, 160 mm.

Fig. 6. *S. pilchardus*, Cornwall, 210 mm.

Fig. 7. *S. pilchardus sardina*, Madeira, 180 mm.

Figs. 8, 9. *S. pilchardus sardina*, Constantinople, 140 mm.

Figs. 10, 11. *S. sagax*, Japan, 200 and 190 mm.

Fig. 12. *S. neopilchardus*, Wellington, N.Z., 230 mm.

II.—*Rhynchotal Notes*.—LX. By W. L. DISTANT.

HOMOPTERA.

Fam. Membracidæ (continued from vol. xvii. p. 330).

Oxyrhachis tenebrosus.

Centrotus tenebrosus, Walk. List Hom. ii. p. 623 (1851).

Hab. Sierra Leone.

Oxyrhachis lamborni, sp. n.

Body and legs piceous brown; tibiæ brownish ochraceous; pronotal carinations paler, more than apical half of posterior pronotal process blackish; membrane subhyaline, the base and costal margin brownish ochraceous, remaining venation and a small spot at posterior angle of inner tegminal margin piceous; pronotum thickly finely punctate, centrally carinate, the lateral processes broad, obtusely acute, a little upwardly

raised and slightly apically recurved, the posterior process moderately compressed, strongly tricarinate, passing tegminal apices, a little depressed a short distance from base, where it is paler ochraceous in hue, the apex moderately concavely attenuated.

Long., incl. post. pronot. process., 6 mm.; exp. ant. lat. process. 3 mm.

Hab. S. Nigeria (*W. A. Lamborn*).

Allied to *O. tenebrosus*, Walk., from which it differs in the longer posterior pronotal process, which distinctly passes the apices of the tegmina, the more slender upturned and apically recurved lateral pronotal processes, &c.

Oxyrhachis pandatus, sp. n.

Pronotum piceous, the central carination, margins, and apical areas of the anterior lateral processes and central area of posterior pronotal process pale testaceous; body beneath and legs ochraceous, the femora piceous; tegmina hyaline, the venation brownish ochraceous, the base blackish; pronotum somewhat coarsely punctate, the anterior lateral processes obliquely upturned, their apices subacute and recurved, their margins distinctly carinate, posterior process passing tegminal apices, the apical area upturned, its apex subacute, its under surface finely obsoletely serrate.

Long., incl. post. pronot. process., 8 mm.; exp. lat. pronot. process. $3\frac{1}{2}$ mm.

Hab. Cameroons (*Escalera*, Brit. Mus.).

Allied to *O. subserrata*, Walk. (Congo and Angola), but differing in smaller size, shorter and upturned lateral pronotal processes, and obsoletely serrate under surface of the posterior pronotal process; from *O. tenebrosus*, Walk. (Sierra Leone), it is to be distinguished by the longer and more upturned posterior pronotal process and by the longer and more acute pronotal lateral processes; it is to be also separated from *O. gambiae*, Fairm. (Senegallia and Calabar), by the longer posterior pronotal process.

Oxyrhachis nigropictus, sp. n.

Pronotum pale testaceous, the frontal area, nearly apical of posterior process, and the face black, the central discal pronotal area with two blackish fasciæ; body beneath and legs blackish, the tibiae pale testaceous; tegmina hyaline, the venation on costal area ochraceous, remaining venation and a small spot at posterior angle of inner tegminal margin blackish; pronotum coarsely punctate, the lateral processes

short and broad, their apices obtusely acute, very slightly upwardly directed, the posterior process tricarinate, moderately compressed, about reaching the tegminal apices, its apex subacute, a little concave centrally.

Long., incl. post. pronot. process., 5 mm. ; exp. pronot. lat. process. 3 mm.

Hab. Brit. E. Africa ; Valley of Upper Nzoia River (*S. A. Neave*).

A small species, to be recognized by the short, broad, lateral pronotal processes and the distinct coloration.

Oxyrhachis yerburyi, sp. n.

Body and legs more or less black ; tegmina hyaline, the base and venation blackish ; pronotum coarsely punctate, the lateral processes long, robust, distinctly carinate, obliquely upwardly directed and apically recurved, the apices obtusely acute, posterior process not reaching the tegminal apices, strongly tricarinate, beyond base compressed and ampliate and upwardly obliquely directed, beneath somewhat obsoletely serrate.

Long., incl. post. pronot. process., $6\frac{1}{2}$ mm. ; exp. lat. pronot. process. $5\frac{1}{2}$ mm.

Hab. Aden (*Col. J. W. Yerbury*).

Allied to *O. versicolor*, Dist., also from Aden, but differing in the more robust and distinctly carinate lateral pronotal processes, the amplified posterior pronotal process, different colour, &c.

Oxyrhachis delalandei.

Oxyrhachis delalandei, Fairm. Ann. Soc. Ent. Fr. (2) iv. p. 268 (1846) ; Fieb. Rev. Ent. (3) iv. p. 13 (1876) ; Oshan. Verz. Pal. Hemipt. Homopt. i. p. 40, n. 154 (1906).

Hab. Sicily, Tunis, Syria, Egypt, Mariût (Dep. Agr. Egypt, Coll. Storey, Brit. Mus.).

Fairmaire gave the habitat of his species as "Cap de Bonne-Espérance" ; but several other of his species also possess a mistaken locality, an error for which he was not responsible and which at that time was of more or less frequent occurrence.

Xiphistes australasiæ, sp. n.

Pronotum brownish ochraceous, more or less shortly palely pilose ; face darker in hue, but also shortly palely pilose, ocelli a little nearer to each other than to eyes ;

tegmina subhyaline, wrinkled, the venation and extreme basal area ochraceous; pronotum with the lateral processes long, directed forwardly and a little upwardly, triquetrous, their apices truncate, inwardly rounded and outwardly obsoletely subacute; posterior process impinging on tegmina and slightly passing the posterior angle of inner tegminal margin; tibiae moderately dilated.

Long., incl. tegm., 7 mm.; exp. lat. pronot. process. 3 mm.

Hab. South Australia.

This genus, hitherto known from the Ethiopian and Oriental regions, is now included in the Australasian region. The specimen was sent me many years ago with some other insects from the Goddefroy collection. It therefore probably came from Queensland, though only labelled "Sud-Austral."

GODDEFROYINELLA.

Allied to *Xiphistes*, but differing in the more robust and regularly convex posterior pronotal process and the reticulated apical tegminal area.

Goddefroyinella indicans, sp. n.

Pronotum piceous, shortly ochraceously pilose; face a little darker, shortly pilose, ocelli nearer eyes than to each other; tegmina subhyaline, the venation piceous, basal area black and punctate; pronotum centrally longitudinally carinate, the lateral processes robust, compressed, directed forwardly and slightly outwardly and upwardly, their apices truncate, their inner and outer areas with several longitudinal carinations, strongly triquetrous, posterior process robust, narrowing on apical area, tricarinate, somewhat convexly rounded, impinging on tegmina, its apex usually reaching tegminal apex, sometimes shorter; tegmina with the apical area more or less reticulate, usually exhibiting four distinct transverse series of small cells, sometimes only three; legs dull testaceous, femora sometimes distinctly darker, tibiae moderately dilated.

Long., incl. tegm., 6-6½ mm.; exp. lat. pronot. process. 3-3½ mm.

Hab. Queensland; Gayndah (Brit. Mus.).

I have dedicated this genus to the memory of the old mercantile house, Goddefroy Bros., of Hamburg, who always instructed their employees who represented them abroad to collect for their museum at home. The type of the genus and species described above was sent me some forty years ago, and has remained undescribed to the present day.

Genus GONGRONEURA.

Pedalion, Buckt. Mon. Membrac. p. 251 (1903), nom. præocc.

Gongroneura, Jacobi, in Sjöstedt, Kilimandj. Exped. xii., Hom. p. 119 (1910), n. nom.

Jacobi rightly substituted the name *Gongroneura* for Buckton's *Pedalion*, a preoccupied name. He, however, with Buckton, misunderstood Fairmaire's species *Oxyrhachis delalandei*, Jacobi making that species as the type of his genus. However, as both the above writers figured their species, no doubt can be felt as to the identity of the genus.

Type, *G. fasciata*, Buckt.

Gongroneura fasciata.

Oxyrhachis delalandii (?), Walk. List. Hom. ii. p. 505 (1851).

Pedalion delalandei, Buckt. (nec Fairm.), Monogr. Membrac. p. 252, pl. lvii. fig. 7 a (1903).

Pedalion fasciatum, Buckt. l. c. p. 253, pl. lx. fig. 8.

Pedalion punctipennis, Buckt. l. c. p. 253, pl. lvii. fig. 8.

Hab. Cape Colony, Natal, Mashonaland.

The differences shown in the figures of the three above species as drawn by Buckton are imaginary. He remarks in his preface:—"Those who use the camera lucida in conjunction with the microscope are well aware that, with its signal advantages, the prism has defects so far as exact drawing is concerned."

Gongroneura confusa, sp. n.

Gongroneura delalandei, Jacobi (nec Fairm.), in Sjöstedt, Kilimandj. Exped. xii., Hom. p. 119, tab. ii. figs. 1, 10, 10 a (1910).

Hab. Usambara.

Genus EUTRYONIA.

Eutryonia, Goding, Proc. Linn. Soc. N.S.W. xxviii. p. 34 (1903).

Hypsoprora, Goding (nec Stål), l. c. p. 35.

Gelastorrhachis, Kirk. Rep. Haw. Plant. Assoc. 1906, p. 372.

Type, *E. monstrifer*, Walk.

Eutryonia monstrifer.

Centrotus monstrifer, Walk. Ins. Saund., Hom. p. 80 (1858).

Oxyrhachis ponderifer, Walk. Journ. Ent. i. p. 316 (1862).

Hypsoprora cassis, Buckt. Monogr. Membrac. p. 60, pl. ix. fig. 2 ♂ (1903); Goding, Proc. Linn. Soc. N.S.W. xxviii. p. 35 (1903).

Eutryonia monstrifera, Goding, l. c. p. 34, pl. i. figs. 10, 11, 22, 26 (1903).

Hab. Australia.

The *Hypsoprora cassis* ♂, Buckt., is only a much mutilated specimen of *E. monstrifer*, Walk. *H. cassis* ♀, Buckt., is (judging from the figure) another mutilated specimen belonging probably to another species. Kirkaldy, in giving *differential* characters for his proposed genus *Gelastorrhachis*, was clearly unacquainted with the type of *Eutryonia*.

Leptocentrus thelwalli, sp. n.

Pronotum, face, body beneath, and legs purplish black, more or less pale ochraceously pilose; scutellum and lateral sternal areas ochraceous; tegmina subhyaline, strongly wrinkled, base and venation fuscous brown, apical margin bronzy ochraceous; pronotum robust, convexly oblique, thickly somewhat finely punctate, lateral processes somewhat short and slender, their apices subacute, slightly backwardly directed, disk faintly centrally carinate, posterior process slender, strongly tricarinate, distinctly passing the posterior angle of inner tegminal margin.

Long., incl. tegm., 7 mm.; exp. lat. pronot. process. 4 mm.

Hab. Nyasaland (*Thelwall*).

This species is to be recognized from the other Ethiopian members of *Leptocentrus* with which I am acquainted by the robustly raised pronotal disk and the declivous posterior pronotal process, which gives it the appearance of a species of *Tricoceps*, from which it is at once separated by the broad, short, and apically emarginate scutellum.

Leptocentrus australis, sp. n.

Head, pronotum, scutellum, and femora black or dark piceous; tibiæ dark ochraceous; a large spot at lateral margins of sternum, a linear spot behind the pronotal lateral processes, and a spot at each basal angle of the scutellum greyish white; tegmina pale bronzy brown, the base reddish brown; pronotum strongly centrally longitudinally carinate, the anterior lateral processes moderately short, directed outwardly, their apices acute and recurved; posterior process tricarinate, elevated above scutellum, and then obliquely recurved to posterior angle of inner tegminal margin, which its apex a little extends beyond; pronotum and scutellum distinctly punctate, the apex of the latter distinctly recurved and elevated.

Long., incl. tegm., $5\frac{1}{2}$ –6 mm.; exp. lat. pronot. process. 3 – $3\frac{1}{2}$ mm.

Hab. South Africa (*Mansell Weale*). Natal; Malvern (*G. A. K. Marshall*).

Genus EMPHUSIS.

Emphusis, Buckt. Monogr. Membrac. p. 256 (1903); Dist. Faun. Brit. Ind., Rhynch. iv. p. 36 (1907).

Emphusis occidentalis.

Centrotypus occidentalis, Goding, Proc. Linn. Soc. N.S.W. xxviii. p. 27 (1903).

Hab. West Australia; Swan River (Brit. Mus.).

Sertorius affinis, sp. n.

Head and pronotum piceous; legs castaneous, apical areas of the tibiae ochraceous; lateral areas of sternum and a spot at each basal angle of scutellum ochraceously tomentose; membrane subhyaline, wrinkled, veins ochraceous, those to costal and subcostal areas castaneous, base piceous; pronotum thickly punctate, the lateral processes slender, acute, strongly outwardly directed, their apical areas black, centrally carinate, the posterior process tricarinate, robust and convex above scutellum, and then straightly directed and attenuate to apex, which just passes the posterior angle of inner tegminal margin.

Long., incl. tegm., 8 mm.; exp. lat. pronot. process. 4 mm.

Hab. New South Wales; Sydney (*J. J. Walker*).

Allied to *S. australis*, Fairm., from which it differs in the more slender, straighter, and acute pronotal lateral processes and the basally convex and apically straight posterior process.

Sertorius castaneus, sp. n.

Head and pronotum castaneous; body beneath more or less ochraceously pilose; legs pale castaneous; lateral areas of sternum and basal angles of scutellum palely ochraceously pilose; tegmina subhyaline, wrinkled, venation ochraceous, base castaneous; pronotum coarsely punctate, moderately centrally carinate, the lateral processes apically acute, outwardly, not upwardly, but distinctly a little backwardly directed, posterior process tricarinate, gradually narrowing from base, impinging on tegmina, but not reaching tegminal apex.

Long., incl. tegm., 8 mm.; exp. lat. pronot. process. $4\frac{1}{2}$ mm.

Hab. Australia (no precise locality).

In colour allied to *S. luteus*, Buckt., but differing in the more rugosely punctate pronotum and its more slender lateral processes; viewed from the front these processes are longer and more straightly directed.

Sertorius luteus.

Spharocentrus luteus, Buckt. Monogr. Membrac. p. 244, pl. lvi. fig. 5 (nec fig. 6, fide Buckt.) (1903).

Acanthucus ? *luteus*, Kirk. Rep. Haw. Plant. Assoc. 1906, p. 379.

Hab. Adelaide.

Buckton's figure of this species (pl. lvi. fig. 6a) has no relation to his *S. luteus*, which is really represented on that plate by fig. 5, ascribed to *S. curvidens*. The type of *S. luteus* is now in the British Museum.

Sertorius insularis, sp. n.

Head and pronotum black; body beneath and legs piceous; lateral areas of the sternum ochraceously pubescent; tegmina subhyaline, wrinkled, the veins dark ochraceous, the base and nearly basal halves of costal and subcostal areas black; pronotum thickly finely punctate, finely and obscurely ochraceously pilose, lateral processes horizontally produced, their obtuse apices a little recurved, posterior process not quite reaching tegminal apices; tegmina with the black areas distinctly punctate.

Long., incl. tegm., 6 mm.; exp. lat. pronot. process. 3 mm.

Hab. Island New Britain.

This species differs from all the other (Australian) species of the genus with which I am acquainted by the obtuse and somewhat straightly produced lateral pronotal processes.

ASPASIANA, gen. nov.

Pronotum moderately convexly gibbous, the posterior process at base distinctly concavely raised above scutellum and then broadly compressed, with the lateral areas globose, before the posterior angle of the inner tegminal margin it is then suddenly narrowed, tricarinate, and convexly depressed and impinging on inner tegminal margin, the anterior lateral processes slender and acute, in the type directed outwardly and very slightly backwardly; face much broader than long, the ocelli near base and closer to each other than to eyes, the posterior margin strongly excavate before the clypeus; tegmina with five apical and two discoidal areas, the central apical vein considerably bent, the inner discoidal area small; legs moderate in size, the tibiæ somewhat sulcate but not dilated.

To be placed near the genus *Sertorius*, Stål.

Type, *A. carbonaria*, Walk. MS.

This species stood under the Neotropical genus *Antonaë*,

Stål, in the British Museum Collection, while the type, labelled "*carbonaria*, Walk.," so far as I can trace, has never been described.

Aspasiana carbonaria, sp. n.

— *carbonaria*, Walk. MS.

Head and pronotum shining black; body beneath thickly ochraceously pilose; femora black or piceous, tibiæ and tarsi brownish ochraceous; tegmina subhyaline, the apical area pale castaneous, extreme base and costal and subcostal veins black; pronotum finely punctate, the globose lateral areas before middle of posterior process impunctate, narrow acute apex not reaching tegminal apices; legs finely pilose; other structural characters as in generic diagnosis.

Long., incl. tegm., $8\frac{1}{2}$ mm.; exp. lat. pronot. angl. $5\frac{1}{2}$ mm.

Hab. New Guinea (*A. R. Wallace*).

Genus CERAON.

Daunus, Stål, Hem. Afr. iv. p. 87 (1866), nom. præocc.

Ceraon, Buckt. Mon. Membrac. p. 228 (1903).

Zanophora, Kirk. Entomologist, xxxvii. p. 279 (1904), n. nom.

Type, *C. tasmaniae*, Fairm. (*Daunus*).

Kirkaldy's new name (*supra*) is rendered unnecessary by Buckton's previously published synonym.

Ceraon rubridorsatum.

Pterosticta rubridorsata, Buckt. Mon. Membrac. p. 230, pl. li. fig. 6 a (1903).

Hab. S. Australia; Adelaide (type in Brit. Mus.).

Ceraon succisus.

Daunus succisus, Buckt. Mon. Membrac. p. 226, pl. l. figs. 3, 3 a (1903).

Hab. S. Australia; Adelaide (type in Brit. Mus.).

Genus ACANTHUSUS.

Acanthusus, Stål, Hem. Afr. iv. p. 87 (1866); Cfv. Vet.-Ak. Förh. 1869, p. 287; Goding, Proc. Linn. Soc. N.S.W. xxviii. p. 13 (1903).

Type, *A. gracilispinus*, Stål.

Acanthusus trispinifer.

Centrotus trispinifer, Fairm. Ann. Soc. Ent. Fr. (2) iv. p. 515, pl. viii. fig. 35 (1846); Walk. List Hom. ii. p. 611 (1851).

Acanthusus trispinifer, Goding, Proc. Linn. Soc. N.S.W. xxviii. p. 15, pl. i. fig. 7 (1903).

Ophicentrus trispinifer, Buckt. Monogr. Membrac. p. 250, pl. lvii. figs. 2, 2 a (1903).

Hab. Australia; Tasmania.

Acanthusus nivalis, sp. n.

Head and pronotum piceous, thickly greyishly pilose; body beneath and legs piceous, lateral areas of sternum thickly greyishly tomentose; a prominent greyish tomentose spot at each basal angle of scutellum; tegmina bronzy, the apical area more distinctly so, the veins (excluding apical area) more or less distinctly greyish, base and costal area piceous and more or less greyishly pilose; pronotum strongly centrally carinate, the lateral processes well produced, moderately flattened, broad at base but acutely narrowed at apices, outwardly not upwardly directed, the apices distinctly recurved, their anterior margins being thus moderately convex, the disk behind these processes gibbously raised into a somewhat large compressed elevation, posterior process almost reaching tegminal apices, strongly tricarinate, concave near base and then convexly impinging on tegmina; ocelli about as far apart from each other as from eyes.

Long., incl. tegm., $3\frac{1}{2}$ –4 mm.; exp. lat. pronot. process. $2\frac{1}{2}$ –3 mm.

Hab. Queensland; Brisbane (*H. Hacker*); Kuranda (*R. E. Turner*).

In fresh examples of this species the greyishly pilose appearance is probably very pronounced.

Acanthusus festivus, sp. n.

Pronotum and face reddish ochraceous, the posterior process from base to near apex pale stramineous, the central carination on frontal area and margins of lateral processes black; femora dark castaneous, their apices and the tibiae and tarsi stramineous; tegmina bronzy brown, a costal spot before apex and a larger apical spot stramineous; pronotum anteriorly very strongly centrally carinate, the lateral processes outwardly triangularly produced, outwardly and apically very slightly upwardly directed, the disk behind these processes strongly gibbously upwardly produced and

moderately compressed, posterior process concave for about half its length from base and thence convex to apex, which nearly reaches the tegminal apex ; ocelli almost as near to eyes as to each other.

Long., incl. tegm., 4 mm. ; exp. lat. pronot. process. $2\frac{1}{2}$ mm.

Hab. Queensland (*F. P. Dodd*).

In this genus the late Mr. Kirkaldy (Rep. Haw. Plant. Assoc. 1907, pp. 90-91) has described three species (two from Queensland), which, however, have certainly nothing to do with the two here described. As, however, Kirkaldy stated that he could not "draw any dividing line" between the genera *Centrotypus*, *Sertorius*, and *Acanthusus*, he may have probably made wrong generic determinations.

SPALIRISES, gen. nov.

Pronotum distinctly centrally carinate, the lateral processes robust, transverse, their apices more or less recurved, posterior process angularly elevated at base, then concavely depressed to beyond scutellum, after which it is convexly curved and impinges on tegminal margins, its apex recurved and distinctly passing posterior angle of inner tegminal margin, the apex subacute ; face globose, with two central obscure tuberculous ridges ; legs simple ; tegmina about twice as long as broad, with four apical and two discoidal cells.

Type, *C. alticornis*, Jacobi.

Spalirises alticornis.

Centrotus alticornis, Jacobi, Deutsch. Zentr.-Afrik.-Exped., Zool. Bd. iv. Lief. 2, Homopt. p. 35, fig. *a* (nec *b*, *c*) (1911).

Hab. Brit. E. Africa, Kericho Station (on black wattle, *Dr. C. M. Dobbs*). Uganda ; Mutanda (*C. H. Marshall*), Mpanga Forest, Toro, 4800 ft. (*S. A. Neave*). Ruwenzori (fide *Jacobi*).

CENTROTUSOIDES, gen. nov.

Pronotum strongly centrally carinate, frontally obliquely declivous, the lateral processes robust, obliquely upwardly directed, their apices obtusely pointed or subtruncate, their margins carinate, and above with a posterior submarginal carination, posterior process moderately compressed, strongly tricarinate, a little raised above scutellum, above which it is broadest and a little convexly arched, and beyond clavus depressed and narrowed, its apex subacute and just passing

the posterior angle of the inner tegminal margin; tegmina somewhat short and broad, three transverse series of prominent cells, four apical, three discoidal, and two subbasal; legs robust, but anterior tibiae not dilated.

This genus is allied to *Centrotus*, but differs from that and allied genera by the peculiar and distinct venation of the tegmina.

Centrotusoides muiri, sp. n.

Pronotum fuscous brown, frontal area and discal base more or less ochraceous; legs fuscous, the apices of the femora and the tibiae ochraceous, lateral areas of sternum (excluding basal angle) greyishly tomentose; tegmina subhyaline, the basal area ochraceous, the venation brownish ochraceous; pronotum finely punctate, with the apices of the lateral processes obtusely pointed and very slightly recurved; other structural characters as in generic diagnosis.

Long., incl. tegm., $6\frac{1}{2}$ mm.; exp. lat. pronot. process. 5 mm.

Hab. Natal; Durban (*F. Muir*).

Centrotusoides wealei, sp. n.

Pronotum fuscous brown, frontal area and discal base more or less brownish ochraceous; legs pale fuscous brown; lateral areas of sternum (excluding basal angle) greyishly tomentose; tegmina subhyaline, the basal angle and the venation brownish ochraceous; pronotum finely punctate, the disk strongly centrally carinate, the apices of the lateral processes broadly truncate, not recurved, the posterior process somewhat greyishly tomentose above the scutellum.

Long., incl. tegm., $6\frac{1}{2}$ mm.; exp. lat. pronot. process. $4\frac{1}{2}$ mm.

Hab. S. Africa (*Mansell Weale*).

This species differs structurally from the preceding (*C. muiri*) by the apically truncated anterior lateral processes of the pronotum.

The late Mr. Mansell Weale's collection of Rhynchota, which I purchased many years ago, and which is now incorporated in the collection of the British Museum, was generally not *locally* labelled, but only described as from South Africa.

BEAUFORTIANA, gen. nov.

Allied to the preceding genus (*Centrotusoides*), but differing by the venation of the tegmina, which possesses only four

apical and two discoidal cells, the subbasal cells being absent; the posterior pronotal process is distinctly raised above the scutellum, after which it is inwardly widened and impinges on tegmina near the apex of clavus, its apical area suddenly narrowed and subacute, the apex just passing the posterior angle of the inner tegminal margin; anterior tibiæ slightly flattened and widened; other characters generally as in *Centrotusoides*, but with the pronotum slightly not strongly centrally carinate.

Beaufortiana cornuta, sp. n.

Body and legs reddish brown, the femora (excluding apices) darker; tegmina subhyaline, the base and venation more or less ochraceous; pronotum thickly finely punctate, the disk centrally finely carinate, the lateral processes somewhat long, upwardly and a little obliquely directed, their apices distinctly recurved, the posterior process as described in generic diagnosis, the frontal and upper surface remotely greyishly pilose; face globose, punctate, greyishly pilose, obsoletely centrally carinate.

Long., incl. tegm., $5\frac{1}{2}$ mm.; exp. lat. pronot. process. 4 mm.

Hab. Cape Colony; Beaufort West.

Beaufortiana difficilis, sp. n.

Body reddish brown; legs black, their apices and the tibiæ ochraceous; tegmina greyish white, venation very pale ochraceous, the base, costal and subcostal veins bright ochraceous; pronotum punctate, obsoletely greyishly pilose, disk very finely centrally carinate, lateral processes transversely oblique, their apices slightly recurved and subacute, posterior process separated from scutellum, beyond which it is amplified beneath, the apical area slender and reaching the posterior angle of the inner tegminal margin; face blackish, globose, centrally obsoletely carinate.

Long., incl. tegm., 4 mm.; exp. lat. pronot. process. 3 mm.

Hab. Cape Colony; Beaufort West.

A smaller species than the preceding (*B. cornuta*), the lateral pronotal processes smaller and less recurved, posterior pronotal process straighter, &c.

GODINGELLA, gen. nov.

Pronotum very strongly rugose and irregularly carinate, strongly centrally carinate, the lateral processes upwardly and outwardly directed, triquetrous, the margins strongly

carinate and the upper surface more or less centrally carinate, the carination of the outer margin is continued along the outer margins of the posterior pronotal process, which is centrally moderately sinuate and reaches or nearly reaches the tegminal apex; ocelli a little nearer to each other than to eyes; face strongly centrally excavate before base of clypeus, eyes large and prominent; tegmina elongate, about three times as long as broad, apical cells elongate.

Allied to *Sarantus*, Stål, from which it is distinguished by the rugosely carinate pronotum and the much more slender and straighter posterior process to same, the narrower tegmina and their different venation. A species insufficiently described by Kirkaldy from Queensland, and which I have not seen, as *Sarantus nobilis* may possibly also belong to *Godingella*, as may also the species described by Goding as *Sertorius giganticus* from South Australia.

I have named this genus after Dr. F. W. Goding, our distinguished pioneer in the study and description of the Australian Membracidae.

Godingella queenslandensis, sp. n.

Pronotum piceous, above slightly or moderately ochraceously pilose, its anterior margin before face and the face itself strongly, longly, ochraceously pilose; eyes ochraceous; legs castaneous, greyishly pilose; sternum thickly greyishly tomentose; tegmina pale bronzy in hue, the venation, base, and about apical third purplish brown; pronotum strongly rugose and carinate, the lateral processes triquetrous, their margins carinate, upwardly and a little outwardly directed, their apices narrowed and recurved, their upper surface distinctly centrally carinate, posterior process strongly tricarinate and almost reaching the tegminal apex; scutellum with a pale ochraceous spot at each basal angle.

Long., incl. tegm., 9-10 mm.; exp. lat. pronot. process. 5 mm.

Hab. Queensland (*F. P. Dodd*).

Genus *SEXTIUS*.

Sextius, Stål, Hem. Afr. iv. p. 88 (1866); Berl. ent. Zeitschr. x. p. 387 (1866); Öfv. Vet.-Ak. Förh. 1869, p. 282; Goding, Proc. Linn. Soc. N.S.W. xxviii. p. 9 (1903).

Plerosticta, Buckt. (part.), Mon. Membrac. p. 229 (1903).

Type, *S. virescens*, Fairm.

Sextius rubrilineus.

Pterosticta rubrilinea, Buckt. Mon. Membrac. p. 230, pl. li. fig. 4 (1903).
Pterosticta xantha, Buckt. l. c. p. 231, pl. li. figs. 7 a, b (1903).

Hab. Adelaide.

In his description of *P. xantha* Buckton writes:—"Pronotum with two subacute short suprahumeral processes, which are only slightly visible by the front aspect." This is shown in his fig. 7 a, but is incorrect, without the specimen is turned upside down and then a little tilted backwards. The figures 4 and 7 appear very different on pl. li., but are the same species, the types of each being now before me.

Sextius spretus.

Pterosticta spreta, Buckt. Mon. Membrac. p. 230, pl. li. fig. 5 a (1903).
Sextius longinotum, Kirk. Rep. Haw. Plant. Assoc. 1906, p. 377.

Hab. Adelaide, Queensland.

In Buckton's type, now before me, the posterior pronotal process extends slightly beyond the apex of the tegmina—the distinctive specific character described by Kirkaldy, but not mentioned by Buckton. This is, however, not a constant character, for in some specimens the posterior process only reaches the tegminal apex.

Sextius virescens.

Centrotus virescens, Fairm. Ann. Soc. Ent. Fr. (2) iv. p. 515 (1846).
Var. *Sextius assimilis*, Kirk. Rep. Haw. Plant. Assoc. 1906, p. 376.

Hab. "New South Wales, Sydney."

Sextius depressus.

Sextius depressus, Goding, Proc. Linn. Soc. N.S.W. xxviii. p. 12 (1903).

Kirkaldy (Rep. Haw. Plant. Assoc. 1906, p. 376) expresses his doubt that this species is distinct from *S. virescens*, Fairm., and states that it "is distinguished by the absence of a cross-vein near the base of the tegmina," but that he had not seen the species. Its character, however, as given by Goding—"lateral horns directed outward, depressed towards apex, never turned upward,"—is one which distinctly marks a series of specimens in the British Museum received from Sydney, Queensland, and elsewhere.

Sextius bucephalus, sp. n.

Pronotum greenish ochraceous; face and legs dark ochraceous; tegmina greenish ochraceous, the apical half more hyaline and reflecting the ochraceous abdomen beneath; pronotum somewhat coarsely punctate, the anterior lateral processes very robust, a little forwardly and upwardly directed, their apices obtusely acute, centrally longitudinally carinate, the posterior process very robust and faintly tricarinate, its apex reaching or slightly passing the tegminal apices; apical areas of the tegmina reticulate.

Long. 6-7 mm.; exp. ant. pronot. process. 3-3½ mm.

Hab. New South Wales, Sydney (*J. J. Walker*).

A number of other specimens are in the British Museum simply labelled "Australia." Differs from *S. virescens*, Fairm., by the more robust and obtuse anterior pronotal processes and the robust posterior process reaching or passing the tegminal apices; from *S. depressus*, Goding, it is to be distinguished by the strong anterior pronotal processes being distinctly obliquely upwardly directed.

Sextius reticulatus, sp. n.

Body and legs ochraceous; face, a transverse fascia between and including the anterior margins of the lateral pronotal processes, and the femora (excluding apices) black; pronotum thickly, rather coarsely punctate, the lateral processes very short, robust, and straightly directed outwardly, finely centrally carinate, the posterior process robust, faintly tricarinate, its apex not reaching the tegminal apices; tegmina with nearly the apical half subhyaline and strongly reticulately veined; the legs and pronotal margin before face are more darkly ochraceous than the upper surface.

Long., incl. tegm., 6½ mm.; exp. lat. pronot. process. 2½ mm.

Hab. Australia; N.W. coast (*Surg. J. Bynoe, R.N.*).

The type of this species was presented to the British Museum in 1844, and is to be structurally identified by the short lateral processes, the robust posterior pronotal process, and the strongly reticulate tegmina; the colour-markings are also very pronounced.

Sextius major, sp. n.

Body and legs pale testaceous; tegmina subhyaline, with the venation reddish ochraceous; pronotum thickly punctate, the lateral processes short, their apices obsoletely

acute, almost straightly produced, longitudinally carinate, the posterior process about reaching tegminal apices, faintly tricarinate, its apical area recurved; tegmina distinctly wrinkled between the veins and usually with a few irregularly scattered small black spots.

Long. 9 mm.; exp. lat. pronot. process. 4 mm.

Hab. Queensland; Peak Downs, Gayndah.

Sextius atromaculatus, sp. n.

Pronotum pale virescent, anterior area between the lateral angles pale purplish red; legs ochraceous; sternum greyishly tomentose; tegmina very pale virescent, the apex pale brownish, a large black spot on upper basal area; pronotum thickly finely punctate, centrally finely carinate, the anterior lateral processes short, broad, obtusely prominent, the posterior process passing the posterior angle of the inner tegminal margin, but not reaching the tegminal apex; apical angles of tegmina reticulate.

Long., incl. tegm., $5\frac{1}{2}$ –6 mm.; exp. lat. pronot. process. 3 mm.

Hab. Queensland (*F. P. Dodd*).

Eufairmairia, gen. nov.

Pronotum with the lateral processes broad, compressed, their broad upper surfaces with several longitudinal strong carinations, more or less subobliquely produced, and more or less broadly apically truncate, the posterior process long, more or less compressed, and broad on its basal area, its lateral areas usually distinctly carinate, its apical area more or less convexly impinging on tegmina, which are about twice or a little more than twice as broad as long, the apical cells elongate and five in number, preceded by two discoidal cells.

Type, *E. decusus*, Walk.

Eufairmairia decusus.

Centrotus decusus, Walk. List Hom. ii. p. 621 (1851).

Sertorius acanthaspis (part.), Goding, Proc. Linn. Soc. N.S.W. xxviii. p. 20 (1903).

Hab. Australia.

Eufairmairia harrisi, sp. n.

Head and pronotum piceous brown; legs and abdomen pale castaneous, the segmental margins ochraceous; tegmina

pale bronzy in hue, venation, base, and costal area (excluding apex) ferruginous brown; pronotum punctate and rugose, the anterior lateral processes obliquely upwardly produced, distinctly narrowed to apices, which are somewhat roundly truncate, their upper surfaces flat and with three longitudinal carinations, strongly, centrally, longitudinally carinate, the posterior process faintly longitudinally carinate on the lateral areas.

Long. $8\frac{1}{2}$ mm.; exp. lat. pronot. process. 5 mm.

Hab. Queensland.

Described from a specimen forwarded by Dr. R. Hamlyn Harris, Director of the Queensland Museum. Allied to *E. decusus*, Walk., but with the anterior lateral pronotal processes narrower, and the lateral carinations on their upper surfaces less profound and somewhat coalescing apically, veins to apical cells of tegmina apically curved, &c.

Eufairmairia relatius, sp. n.

Head, pronotum, sternum, and legs piceous; lateral areas of sternum and basal angles of scutellum ochraceously tomentose; tegmina subhyaline, the venation ochraceous, base and about basal half of costal area ferruginous brown; pronotum finely rugose and punctate, centrally carinate, the lateral processes moderately broad, compressed, obliquely directed upwardly, apically truncate, their upper surfaces longitudinally carinate, posterior process tricarinate, almost reaching tegminal apex; base and about basal half of costal area to tegmina punctate.

Long., incl. tegm., 8 mm.; exp. lat. pronot. process. 5 mm.

Hab. Queensland; Gayndah.

Allied to *E. decusus*, Walk., but with the lateral pronotal processes much less produced and seen from the front more apically acute, the posterior process apically a little broader and laterally more distinctly carinate; it differs from the following species, *E. consobrinus*, by the more upwardly directed lateral pronotal processes, which are also less convex and more truncate.

Eufairmairia fraternus, sp. n.

Head and pronotum dull testaceous, faintly ochraceously pilose; legs a little paler testaceous; lateral areas of sternum and basal angles of scutellum greyishly or pale ochraceously tomentose; tegmina pale hyaline, venation dull testaceous, base black, basal half of costal area, and base of discoidal

area ferruginous; pronotum finely wrinkled and punctate, centrally longitudinally carinate, the lateral processes obliquely raised, a little narrowed to their apices, which are also a little obliquely roundly truncate, their upper surfaces longitudinally carinate, posterior process with the lateral areas carinate, its apex passing the posterior angle of inner tegminal margin, but not reaching tegminal apex.

Long., incl. tegm., 7-8 mm.; exp. lat. pronot. process. $4\frac{1}{2}$ -5 mm.

Hab. Queensland; Gayndah and Gatton. N.S.Wales; Capertee, Rylstone, and Lyndhurst.

Allied to *E. relatus*, Dist., but differing in the shorter posterior pronotal process, the more apically rounded and angulate lateral pronotal processes, different colour, &c.

Eufairmairia consobrinus, sp. n.

Head and pronotum dark purplish brown; sternum and legs a little paler; lateral areas of sternum and basal angles of scutellum greyishly tomentose; tegmina subhyaline, the venation ochraceous, base and basal half of costal area purplish brown; pronotum coarsely wrinkled and punctate, centrally longitudinally carinate, the lateral processes broad, compressed, obliquely upwardly directed, their apices roundly truncate, the posterior apical angle acute. their upper surfaces distinctly longitudinally carinate, posterior process reaching or almost reaching the tegminal apex, tricarinate.

Long., incl. tegm., 7-8 mm.; exp. lat. pronot. process. 5 mm.

Hab. Queensland; Rockhampton, Gayndah, Peak Downs. N.S.Wales; Coolabah. Victoria; Mallee.

From the preceding species *E. consobrinus* may be distinguished by the apically roundly truncate and posteriorly angularly acute lateral pronotal processes.

Eufairmairia acanthaspis.

Centrotus acanthaspis, Fairm. Ann. Soc. Ent. Fr. (2) iv. p. 515 (1846).
Sertorius acanthaspis, Goding (part.), Proc. Linn. Soc. N.S.W. xxviii. p. 20 (1903).

This species is to be distinguished from the other species of the genus by the ochraceous tibiæ ("fémurs noirs, tibias jaunâtres"); in the specimen now before me the femora are more piceous brown, the bases of the tibiæ are also the same colour; the lateral pronotal processes are directed outwardly and a little obliquely upwardly, the posterior angle being

acute, their upper surfaces with several longitudinal carinations, the posterior process reaches the apex of the abdomen but not the tegminal apices.

Long., incl. tegm., 9 mm.; exp. lat. pronot. process. $4\frac{1}{2}$ mm.

Hab. New South Wales; Port Jackson (*Fairmaire*). Queensland; Rockhampton (Brit. Mus.).

Allied to *E. consobrinus*, Dist., from which it differs in the slightly longer but much narrower lateral pronotal processes and their more acute apices, shorter posterior pronotal process, &c.

Eufairmairia distinctus, sp. n.

Head and pronotum black; sternum much suffused with greyish pubescence; legs black, more or less greyishly pubescent; interior angle of sternum and the scutellum pale ochraceous; tegmina pale bronzy with darker suffusions, base black immediately followed by an obscure pale transverse fascia; pronotum thickly punctate and strongly, centrally, longitudinally carinate, the lateral processes broad, outwardly and a little upwardly directed, their apices roundly truncate but with the posterior angle acute, the upper surface with three strong longitudinal carinations, posterior process very robust and compressed for about two-thirds its length from base, where its upper surface is also convex, its apical area attenuated and reaching the posterior angle of the inner tegminal margin, its broad lateral margins with two strong carinations; ocelli about as near to eyes as to each other; clypeus strongly greyishly pilose.

Long., incl. tegm., 7 mm.; exp. lat. pronot. process. 5 mm.

Hab. North Australia; Port Darwin.

A very distinct species, the robust posterior pronotal process separating it from all the other described species.

Eufairmairia (?) *cupreus*, sp. n.

Face and clypeus black; pronotum brownish ochraceous, its basal frontal area black; sternum blackish, thickly greyishly pilose; abdomen beneath brownish ochraceous, the segmental margins paler; legs brownish ochraceous; tegmina pale hyaline, the venation and extreme base brownish ochraceous; pronotum coarsely punctate, the lateral processes triangular, outwardly and a little obliquely produced, their apices acute and slightly recurved, their upper surfaces very obsoletely carinate; the posterior process robust for about half its length, the apical area roundly depressed, its

apex reaching the tegminal apices; ocelli about as near to eyes as to each other.

Long., incl. tegm., 8 mm.; exp. lat. pronot. process. 5 mm.

Hab. S.W. Australia; Yallingup (*R. E. Turner*).

I have provisionally included this species in the genus, though the lateral pronotal processes are aberrant. By the colour-markings it appears to be allied to the species described by Goding as *Sertorius tepperi*.

CEBES, gen. nov.

Body elongate; tegmina about two and a half times as long as broad ("the third apical cell, very long and narrow, crossed by several transverse venules," *Goding*); pronotum centrally carinate, the anterior lateral processes triquetrous, conical, more or less directed outwardly and a little upwardly; posterior process tectiform, almost straight, slightly narrowed above scutellum, gradually acuminate to apex, curved downward, impinging on tegminal margin and reaching tegminal apices (at least, in type); ocelli above a line passing through the centre of the eyes, from which they are nearly as far apart as from each other.

Cebes transiens.

Centrotus transiens, Walk. List Hom. ii. p. 624 (1851).

Sertorius areolatus, Goding, Proc. Linn. Soc. N.S.W. xxviii. p. 23 (1903).

Hab. South Australia.

Cebes godingi, sp. n.

Head, pronotum, and legs testaceous; tegmina subhyaline, wrinkled, the base and veins testaceous; pronotum thickly, somewhat finely punctate, the anterior lateral processes very robust, only obtusely narrowed at apices, moderately directed upwardly and outwardly, the margins distinctly carinate, the anterior area centrally carinate, the posterior process tricarinate, its apex slightly passing the tegminal apices; tegmina with the third apical cell crossed by several transverse venules.

Long., incl. tegm., 6 mm.; exp. lat. pronot. process. 4 mm.

Hab. Australia (Buckton Coll.).

Allied to *C. areolatus*, Goding, but with the anterior lateral pronotal processes very much more robust and less acute apically, posterior process passing tegminal apices, different colour, &c.

This species was labelled but not described in Buckton's Collection as *Centruchoides rubridorsi* (other species, mostly mutilated, belonging to other genera, also bearing a similar label and undescribed).

Otinotus doddi, sp. n.

Head and pronotum fuscous brown, palely pilose, frontal pronotal area and face very longly and densely palely pilose; lateral areas of sternum and the scutellum pale ochraceous; legs pale brownish, shortly pilose; tegmina pale hyaline, wrinkled, the prominent veins dull ochraceous, basal area fuscous and pilose; pronotum very strongly centrally carinate, the anterior lateral processes broad at base, subacute at apices, directed outwardly and a little upwardly, the apices slightly recurved, posterior process robust, beyond middle narrowing to apex, a little convexly raised at base, impinging on tegmina beyond scutellum, the apex passing the posterior angle of the inner tegminal margin.

Long., incl. tegm., 5 mm.; exp. lat. pronot. process. 3 mm.

Hab. Queensland (*F. P. Dodd*).

Otinotus albosignatus, sp. n.

Head and pronotum castaneous; legs brownish ochraceous; basal angles of scutellum and lateral areas of sternum whitely tomentose; tegmina pale bronzy brown, the apical margin a little darker, the venation prominent; pronotum thickly coarsely punctate, strongly centrally carinate, the posterior process tricarinate, the anterior lateral processes long, broad at base, subacute at apices, directed obliquely upwardly, apices not recurved, posterior process nearly straight, beyond scutellum impinging on tegmina, the apex acute, passing the posterior angle of inner tegminal margin, but not reaching the tegminal apices.

Long., incl. tegm., 7 mm.; exp. lat. pronot. process. $4\frac{1}{2}$ mm.

Hab. Queensland (*F. P. Dodd*).

Otinotoides australis, sp. n.

Pronotum brownish ochraceous, the anterior pronotal lateral processes black or nearly black, and the area between them darker castaneous, posterior process (excluding base) black; face pale castaneous; femora pale castaneous, their apices and the tibiae and tarsi stramineous, tarsal claws black; tegmina dull stramineous, base, costal and subcostal

areas, and the apical margin black ; pronotum punctate, the lateral processes long, subacute, directed outwardly and a little upwardly, centrally carinate, the posterior process tricarinate, touching the scutellum and then moderately convexly elevated, its apical half roundly deflected, its apex slender, subacute, and almost reaching the tegminal apex ; the dark areas of the tegmina more or less distinctly punctate.

Long., incl. tegm., 5 mm. ; exp. lat. pronot. process. $3\frac{1}{2}$ mm.

Hab. Queensland (*F. P. Dodd*).

Otinotoides solomonensis, sp. n.

Head and pronotum black, shortly, obscurely, palely pilose ; body beneath black, lateral areas of sternum, narrow lateral margins of pronotum, and basal angles of scutellum greyishly tomentose ; legs black, apices of femora ochraceous ; tegmina purplish brown ; pronotum punctate, with the anterior lateral processes somewhat long and acute, directed outwardly and upwardly, their apices moderately recurved, centrally carinate, the posterior process tricarinate, somewhat robust, touching the scutellum, where it is also moderately convexly elevate, its apical half roundly deflected, its apex passing the posterior angle of the inner tegminal margin but not reaching tegminal apices, the tegmina are strongly wrinkled, the base, costal and subcostal areas punctate.

Long., incl. tegm., $5\frac{1}{2}$ mm. ; exp. lat. pronot. process. 4 mm.

Hab. Solomon Islands (*W. W. Froggatt*).

Otinotoides intermedius, sp. n.

Centrotus intermedius, Buckt. MS.

Head and pronotum testaceous brown, obscurely, thickly, shortly, palely pilose ; body beneath and legs testaceous brown ; lateral areas of the sternum and basal angles of scutellum palely ochraceously tomentose ; tegmina subhyaline, most of the venation, basal portions of the costal and subcostal areas, and the base testaceous brown ; pronotum punctate, centrally carinate, the lateral processes robust, upwardly and outwardly directed, their apices obtusely acute and a little recurved, their margins distinctly carinate, posterior process tricarinate, robust, touching the scutellum, above which it is a little convexly elevate, its

apical half roundly deflected, its apex almost reaching the tegminal apices, the dark areas of the tegmina punctate.

Long., incl. tegm., 5 mm.; exp. lat. pronot. process. 3 mm.

Hab. South Australia; Largs Bay (*Tepper*, Buckt. Coll.). Queensland; Gayndah, Peak Downs.

This species was contained in the Buckton Collection named as above, but I can find no trace of a published description. I therefore conserve the name and describe the species.

Otinotoides spicatus, sp. n.

Head and pronotum fuscous brown, obscurely, shortly, palely pilose; body beneath and legs fuscous brown; lateral areas of the sternum and basal angles of the scutellum palely ochraceously tomentose; tegmina more or less fuscous brown, the central portion of claval area with somewhat obscure brassy reflections; pronotum punctate and shortly obscurely pilose, strongly centrally carinate, the lateral processes broad and somewhat flattened on basal areas, subacute at apices, outwardly and a little upwardly directed, their apices distinctly recurved, posterior process somewhat slender, its apical half roundly deflected, the apex acute and passing the posterior angle of the inner tegminal margin, but not reaching the tegminal apices; basal, costal, and subcostal areas of the tegmina punctate.

Long., incl. tegm., 6 mm.; exp. lat. pronot. process. 4 mm.

Hab. Queensland (*F. P. Dodd*).

Tshaka obortus, sp. n.

Head, pronotum, and scutellum black, obscurely shortly pilose; body beneath and femora black, tibiae more castaneous, tarsi ochraceous; tegmina usually very pale bronzy brown, a blackish spot at posterior angle of inner tegminal margin and the base black; pronotum finely punctate, the lateral processes long, outwardly directed, moderately curved, the apices subacute, centrally longitudinally carinate, the posterior process moderately slender, tricarinate, sinuately directed downwardly, its apex just passing the posterior angle of inner tegminal margin.

Long., incl. tegm., $4\frac{1}{2}$ –5 mm.; exp. lat. pronot. process. 3 – $3\frac{1}{2}$ mm.

Hab. Transvaal; Pretoria (forwarded by Mr. Claude Fuller to the Imperial Bureau of Entomology).

Allied to *T. naturalis*, Dist., but differing in the smaller size, longer and more acute lateral pronotal processes, which, when viewed from the front, are nearly straight in *T. naturalis* and strongly curved in *T. abortus*.

Crito, gen. nov.

Pronotum roundly gibbous before scutellum, the lateral processes short, acute, more prominent when viewed from the front than from behind, where they appear to be shorter and less acute; posterior process resting on scutellum at base, beyond middle (where it is sinuate) attenuated, impinging on tegminal margin, but not reaching tegminal apex; tegmina about twice as long as broad, five apical areas, preceded by two discoidal areas; face somewhat short, ocelli almost in line with upper margins of eyes, from which they are scarcely farther apart than from each other.

A genus to be placed near *Ebhul*, Dist., from which, however, it is to be separated by the short but distinct lateral pronotal processes and by the sinuate but not waved posterior pronotal process.

Crito festivus, sp. n.

Head, pronotum, and body beneath piceous; lateral areas of sternum and a large spot at each basal angle of scutellum greyishly tomentose; femora piceous, their apices and the tibiae and tarsi pale ochraceous; tegmina subhyaline, with a bronzy tint, the venation black, apical third pale castaneous where the venation is concolorous, apical margin purplish brown; pronotum coarsely punctate; base of tegmina and base of costal area punctate; other structural characters as in generic diagnosis.

Long., incl. tegm., 5 mm.; exp. lat. pronot. process. 3 mm.

Hab. Queensland (*F. P. Dodd*).

Anzac, gen. nov.

Body subelongate (face mutilated in the Fabrician type); pronotum subelongate, laterally unarmed, but angulate at base above eyes, anteriorly a little globosely truncate, centrally longitudinally carinate, the posterior process robust, broad at base, straight, tricarinate, gradually narrowing to apex, which is subacute, and about reaching posterior angle of inner tegminal margin: scutellum concealed; femora

moderately thickened; tegmina extending beyond the abdominal apex, subhyaline, apical areas six, anteapical cells four.

Type, *A. bipunctatus*, Fabr.

This genus is allied to *Kanada*, Dist., which at present contains one species from Bengal, and belongs to my division Gargararia. The type is in the Banksian Collection contained in the British Museum, and is here figured. The species has been hitherto ascribed to the genus *Sextius*. Stål, in his 'Hemiptera Fabriciana,' had evidently not seen it when he placed it in *Sextius*. Kirkaldy (Rep. Haw. Plant. Assoc. 1906, p. 376) records the species in error, for he writes "the lateral horns turned a little forwards." Goding remarks that he had not seen the species, but doubted if it was distinct from *Sextius virescens*, Fairm.

Anzac bipunctatus.

Membracis 2-punctata, Fabr. Syst. Ent. p. 677 (1775); Spec. Ins. ii. p. 318 (1781); Mant. Ins. ii. p. 265 (1787).

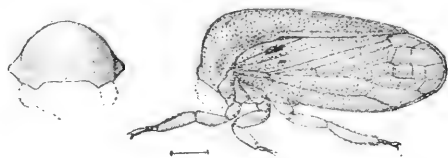
Centrotus 2-punctatus, Fabr. Syst. Rhynch. ii. p. 19 (1803).

Sextius bipunctatus, Stål, Hem. Fabr. ii. p. 52 (1869); Goding, Proc. Linn. Soc. N.S.W. xxviii. p. 12 (1903).

Body, tegmina, and legs pale tawny brown; tegmina with two black spots near base.

Long. 5 mm.; exp. pronot. angl. 2 mm.

Hab. Australia (Banksian Collection).



Anzac bipunctatus, Fabr.

III.—*Descriptions and Records of Bees.*—LXXIII.

By T. D. A. COCKERELL, University of Colorado.

NOTOCOLLETES, gen. nov. (Colletidæ.)

Closely related to *Goniocolletes*, Kkll., but with only two submarginal cells.

Male.—Colletiform, hairy; tongue deeply emarginate; blades of maxillæ broad, short, and rounded, with a peculiar

roughened (microscopically cancellate) surface; maxillary palpi long, with six subequal joints; flagellum very long and slender; stigma long and narrow, obtuse at apex. Wings hairy; marginal cell ending rather obtusely, a little away from costa, with a very minute appendiculation; costa above marginal cell with a conspicuous fringe of dusky hair; second s.m. very long, receiving first r. n. far from base (distance a little greater than length of first t.-c.); second r. n. meeting second (morphologically third) t.-c.; b. n. arched, falling just short of t.m., which is not very oblique. Anterior tarsi short, the basal joint with long hair; middle femora produced beneath, subtriangular, the lower anterior face with a large basin-like depression; middle tarsi short, the basitarsus very broad, parallel-sided, truncate at end, longer than the other joints together; hind tibiæ not far from twice as long, and much more than twice as bulky as anterior or middle ones, with very long hair in front and behind; hind basitarsi broad at extreme base, with a spine, the outer side of which bears long hair, but on the posterior side, away from the spine, prolonged into a long curved extremely slender structure, ending in a flattened lamina, and longer than the other four joints together; pulvilli large; claws bifid at end. Abdomen with hind margin of fifth ventral segment elevated and greatly thickened in middle; sixth ventral segment with a great thickened elevation, which has a sloping smooth triangular anterior face.

Notocolletes heterodoxus, sp. n.

♂.—Nearly 11 mm. long.

Head, thorax, and abdomen with long erect very pale ochreous-tinted hair, not forming bands on abdomen; head and thorax black, abdomen dark dull blue-green; malar space obsolete; mandibles bidentate, black; face densely covered with appressed hair, which shines like a plate of polished silver in certain lights; scape black, flagellum obscure reddish; front flattened, entirely dull; mesothorax entirely dull, impunctate; scutellum shining, its hair strongly brownish; area of metathorax dull, without plicæ, but its margin plicatulate; legs black, the anterior and middle tibiæ mainly red in front, and the tarsi partly ferruginous; tegulæ black, rather small. Wings reddened, stigma dark reddish, nervures fuscous. Abdomen rather elongate.

Hab. "Gawter. D. S. Austr." [Gawler Range?] (British Museum, from F. Smith's collection).

An extraordinary bee, related to the species of *Gonocolletes*.

Paracolletes abnormis, sp. n.

♂.—Length about 6 mm.

Rather slender; black, with dull white hair, the face and front densely covered with long shining white hair, completely hiding the surface up to level of anterior ocellus; the hair on front is abruptly limited above, and the portion of the vertex carrying the large ocelli is flattened and depressed, so as to appear part of the front, forming a basin bounded above by a shining rim on each side, the vertex forming the upper margin of the head narrow (antero-posteriorly) and rounded; cheeks small; mandibles with a dark red mark in middle; scape black; flagellum pale ferruginous beneath (including apical joint), dusky red above; mesothorax shining, with sparse small punctures; area of metathorax semilunar, with very indistinct rugæ; legs black, with the knees, anterior tibiæ in front, the other tibiæ at apex, and all the tarsi, clear ferruginous; tarsal joints 2 to 4 broad-triangular, giving the tarsi in this region an unusual thickened appearance; tegulæ pale testaceous. Wings hyaline, nervures and the rather large stigma; b. n. arched, the lower part nearly vertical, almost reaching t.-m., which is hardly at all oblique; only two s.m. cells, the very long second receiving the recurrent nervures near base and apex; on one side can be seen above a minute stump representing the lost second t.-c., it is halfway between the first t.-c. and the insertion of the third on the marginal cell; marginal cell long, rather obliquely truncate at apex. Abdomen shining, with extremely fine punctures, no hair-bands, but the surface thinly hairy; fifth ventral segment with a long dense fringe of white hair, longest at sides.

Hab. Alexandria, N. Australia (*W. Stalker*; British Museum).

P. abnormis is a very peculiar species, which, from having only two s.m. cells, would be associated with *P. vitrifrons* (Sm.) and *Andrenopsis flavorufus*, Ckll., but it is not closely related to either of these*.

Paracolletes nitidulus, sp. n.

♀ (Type).—Length 9.5–10 mm.

Shining black, not very robust, with thin white hair; vertex with long black hair; mesothorax and scutellum with

* Since writing the above, I find that I overlooked a second specimen of *P. abnormis* from the same locality. This has three submarginal cells in both anterior wings; the second s.m. small, receiving the first r. n. about the middle.

a little black hair scattered over the surface; face bare, with white hair at sides; abdomen with broad but thin marginal white hair-bands at sides of second and third segments, and right across on fourth; fifth segment and apex with heavy black hair, but the fifth with glittering white hair at sides; venter with broad but thin bands of glittering white hair, the last tinged with ochreous; head broad; blades of maxillæ smooth and polished; clypeus shining, with large punctures, more or less in rows; no clypeal keel, but front with a delicate keel, strongly elevated between antennæ; front dull and punctured, with the sides broadly and abruptly smooth and polished; antennæ ordinary, scape closely punctured, flagellum with apical joint more or less rufous; mesothorax shining, with fine well-separated punctures; scutellum flattened, with larger punctures; mesopleura nearly impunctate; area of metathorax triangular, with fine and indistinct cross-striæ; legs black, with pale hair, that of tarsi and outer side of tibiæ brownish; scopa on lower side of hind tibiæ long and clear white; tegulæ piceous. Wings brownish, stigma (which is large) and nervures dark brown; marginal cell rounded at end; b. n. falling just short of t.-m., which is extremely oblique; second s.m. small, narrowed above, receiving first r. n. at about end of its first third; third s.m. large and long, receiving second r. n. a considerable distance from apex. Abdomen shining, with very minute inconspicuous punctures; first segment polished, the others not entirely smooth; pygidial plate large and broad, obtuse.

♂.—Length about 8.5 mm.

Slender; face covered with shining white hair, very dense and silvery at sides; cheeks with very long white hair; frontal carina little developed; front dull, with only narrow indistinct glittering bands along orbits; antennæ slender, not very long for a male, black, flagellum obscure brown beneath; scutellum flattened on disc, sparsely punctured; mesothorax and scutellum with abundant long black hair, as also the vertex; anterior femora above and (except base) in front, and their tibiæ in front, ferruginous; abdomen without bands on apices of segments, but pale hair at extreme base of fourth; apical plate small, broadly rounded; fourth and fifth ventral segments with broad stiff hair-bands, that on fourth creamy-white, that on fifth dark fuscous, nearly black. Hind wings with a conspicuous black apical spot.

Hab. Yallingup, S.W. Australia, middle of September to November, 1913, 5 ♀, 1 ♂ (*R. E. Turner*; British Museum).

An ordinary-looking species, but entirely unique by the large black spot at end of marginal nervure of hind wing of male. In the female this is represented by a much smaller, elongated spot.

Paracolletes nigrutilus, sp. n.

♀.—Length about 7 mm.

Not very robust; shining black, with scanty white hair; black hair on vertex, and a little on thorax above; legs with white hair, dark fuscous on outer side of tibiae and tarsi; abdomen with very scanty pale hair, not forming bands, although it is more abundant along hind margins of third and fourth segments; hair at apex of abdomen dark fuscous; venter with white hair-bands; head broad; clypeus highly polished, with large punctures; supraclypeal area almost without punctures; front shining, with scattered punctures; flagellum obscure reddish beneath; mesothorax and scutellum highly polished, with very sparse exceedingly small punctures; area of metathorax smooth, triangular, with a transverse obtuse angulation separating the apical vertical face, which is produced; legs black; tegulae fuscous. Wings strongly brownish, the rather narrow stigma and the nervures rufo-fuscous; marginal cell truncate at end; b. n. meeting the very oblique t.-m.; second s.m. small, receiving first r. n. in middle; third s.m. receiving second r. n. some distance from end (the distance about equal to upper side of second s.m.). Abdomen shining but microscopically sculptured, without evident punctures; hind margins of segments rather obscurely pallid.

Hab. Yallingup, Nov. 1913 (*R. E. Turner*; British Museum), 2 ♀.

Readily known by the small size, dusky wings, and especially the truncate marginal cell. The clypeus is quite convex and prominent.

Paracolletes simillimus, sp. n.

♂.—Length about 10.5 mm.

Shining black, the first three abdominal segments with a faint purplish lustre in certain lights, but not properly described as metallic; hair of head and thorax quite abundant, variously coloured, as follows: long and white on face and lower part of front, but with a faint creamy tint, contrasting with the pure white of the long and very abundant hair on lower part of cheeks; vertex, most of front, mesothorax, and scutellums with thin erect dark

fuscous hair ; a tuft of fuscous just below wings, but pleura and metathorax with long loose white hair ; tubercles, region just behind, and adjacent corners of mesothorax with cream-coloured hair, dense and conspicuous on tubercles ; legs with mainly white hair, long and spreading on hind legs ; on inner side of hind basitarsi the hair appears soot-colour in some lights and silvery-white in others ; abdomen without bands, but with thin erect white hair, partly black on third and fourth segments, and all black beyond ; hind margin of fourth ventral segment with a broad stiff fringe of fuscous hair ; face broad ; eyes prominent, moderately converging below ; mandibles red apically ; antennæ black, not very long for a male ; mesothorax and scutellum shining, sparsely punctured, the scutellum with a median groove ; area of metathorax large, triangular, with obscure cross-striæ, but no transverse keel ; legs ordinary, hind tarsi long ; tegulæ piceous. Wings strongly brownish, with the base colourless ; the nervures and lanceolate stigma dark fuscous ; marginal cell obtuse at end ; b. n. falling a little short of the very oblique t.-m. ; first r. n. joining second s.m. very near its beginning, second r. n. joining third s.m. some distance from its end. Abdomen polished and shining, with minute piliferous punctures.

Hab. Yallingup, Nov. 1913, 2 ♂ (*R. E. Turner* ; British Museum).

This looks like *P. metallescens*, Ckll., but the sculpture of abdomen is entirely different.

Paracolletes perpolitus, sp. n.

♂.—Length about 9.5 mm.

Robust for a male, with elongate-pyriform abdomen ; black, the head and thorax brilliantly shining, the abdomen duller, with very fine punctures, the hind margins of the segments depressed and brown ; hair of head and thorax long and quite abundant, white, but on vertex, mesothorax, and scutellum greyish-fuscous ; legs with pale hair ; abdomen with very little hair, and no hair-bands, apical segments with dark hair ; ventral segments with thin bands of white hair, but no stiff fringe ; mandibles black ; clypeus broadly overlapped by hair, but the disc bare, flattened, polished, shining, almost wholly impunctate, with a low median ridge ; antennæ ordinary, flagellum ferruginous apically ; mesothorax and scutellum polished, with sparse punctures ; area of metathorax shining, finely transversely striated, obtusely transversely ridged or angled ; legs black, with last tarsal

joint ferruginous, and anterior tibiæ largely red in front; tegulæ dark brown. Wings hyaline; stigma rather small, reddish with a dark margin; nervures fuscous; b.n. almost reaching t.-m.; first r. n. joining second s.m. before middle, second r. n. joining third s.m. very near end; marginal cell rounded at end; third s.m. elongated, and very broad above. Apical plate of abdomen red, rounded, subtruncate.

Hab. Yallingup, Dec. 1-12, 1913 (*R. E. Turner*; British Museum).

Very close to *P. incanescens*, Ckll., which has the same type of clypeus, but third submarginal cell quite differently shaped, abdomen more finely punctured, and flagellum red at end.

Paracolletes minutus, sp. n.

♂.—Length a little over 6 mm.

Shining black, but head, thorax, and abdomen closely and very distinctly punctured, the hind margins of abdominal segments depressed and broadly brown; hair of head and thorax white, tinged with brown on vertex and scutellum, sides of face and lower part of front with long pure white hair; abdomen without hair-bands; head broad, but facial quadrangle much longer than broad, narrowing below; mandibles ferruginous, only the base black; clypeus flattened in middle, with large punctures; front very densely punctured; flagellum obscure brown beneath; mesothorax densely and strongly punctured, scutellum with very dense smaller punctures; area of metathorax dull and rugose; pleura strongly punctured; legs black, with white hair, anterior tibiæ reddish in front; tegulæ pellucid brown. Wings rather short, dusky hyaline; stigma lanceolate, reddish with dark margin; nervures fuscous; marginal cell narrowly rounded at end; b. n. falling just short of t.-m.; second s.m. receiving first r. n. well before middle; third s.m. broad above, receiving second r. n. a moderate distance (equal to distance of first r. n. from base of second s.m.) from apex. Abdomen, except the broad depressed apical margin of segments, densely and finely punctured, with elevated ridges at sides just before the depressions; third and fourth ventral segments with long fringes of white hair, fifth with a fringe of very short yellowish hair.

Hab. Yallingup, Nov. 1913 (*R. E. Turner*; British Museum).

Easily known from *P. punctatus* (Sm.) by the closely punctured thorax and colour of antennæ and nervures.

Paracolletes eucalypti, sp. n.

♂.—Length about 10 mm.

Head blue-green, the lower part of clypeus black; thorax dark blue, mesothorax green, with middle of disc discoloured; hair of head and thorax mostly black, but white on lower two-thirds of pleura and on cheeks; mandibles and antennæ black; abdomen rich deep purple-blue, hair at apex black. Exceedingly like *P. carinatus* (Sm.), both sexes of which were taken on the same plant at the same time, but easily distinguished by the narrower abdomen, which is transversely microscopically lineolate-punctate (making a dullish, not polished, surface), and is only extremely indistinctly punctured; the b. n. falling short of t.-m.; and the dark red tibiae.

Hab. Mt. Yule, Healesville, Victoria, on *Eucalyptus calophylla rosea*, Feb. 20, 1915 (*R. Kelly*; British Museum).

This resembles *P. castaneipes*, Ckll., as to the legs, but has much smaller eyes and broader face. It is related to *P. subviridis*, Ckll., but the abdomen is quite differently coloured.

Paracolletes moniliformis, sp. n.

♂.—Length 9 mm.

Rather slender; head and thorax shining black; abdomen obscurely purplish on first two segments, greenish and purplish on third, and greenish on the others; hair of head and thorax long, white with a slight ochreous tint, dark fuscous on vertex, and mixed with fuscous on dorsum of thorax; face extremely broad, facial quadrangle broader than long; mandibles black, obscurely red at apex; vertex impunctate; antennæ black, the flagellar joints moniliform; mesothorax shining, only feebly punctured; area of meta-thorax polished, with no sharp transverse keel; legs black, with pale hair; tegulae dark brown. Wings dusky, nervures and stigma piceous; first r. n. joining second s. m. in middle. Abdomen with a dullish, sericeous surface, no hair-bands; apical plate broad, truncate; venter with thin glittering white hair.

Hab. Yallingup, S.W. Australia, Sept. 14–Oct. 31, 1913 (*R. E. Turner*; British Museum).

Closely allied to *P. ibex*, Ckll., with similar flagellum, but larger, with brownish wings and dark stigma.

Paracolletes clypeatus, sp. n.

♂.—Length about 10 mm.

Rather robust; head and thorax shining black, abdomen dark purple; hair of head and thorax long and abundant, white on face, cheeks and occiput, black on vertex, pale grey (mouse-grey) on thorax; head broad; mandibles black, faintly reddish apically; clypeus and supraclypeal area exposed, nearly bare, flattened, longitudinally striate, and with a median keel; antennæ black, only moderately long, flagellum submoniliform; mesothorax polished, with sparse small punctures; area of metathorax transversely striate; legs black, with the last tarsal joint and patch on inner side of anterior tibiæ red; spurs bright ferruginous; tegulæ piceous. Wings very short, hyaline, faintly dusky apically; stigma and nervures fuscous; stigma very small; first r. n. joining second s.m. about middle. Abdomen without hairbands; hair at apex and on venter black.

♀.—Length about 11 mm.

Robust, with the same facial structure, the median keel going some distance up front; hind tibiæ with an enormous scopa, entirely black.

Hab. Yallingup, S.W. Australia, Nov. and Dec. 1913 (*R. E. Turner*; British Museum).

Entirely unique by the peculiar structure of the face. The male is the type.

Paracolletes ferricornis, sp. n.

♂.—Length a little over 11 mm.

Robust; black, with head, thorax, and abdomen abundantly clothed with long pale fulvous hair; eyes large, pea-green, inner orbits parallel; facial quadrangle much longer than broad; mandibles bidentate, black, with or without a red spot near middle; ocelli far below level of top of eyes; scope very short, black, hairy; flagellum long, entirely very bright ferruginous; third antennal joint very long, slender, shining; mesothorax shining, with small irregular punctures; scutellum closely punctured except the anterior margin, which is polished and impunctate; area of metathorax triangular, without any distinct sculpture, but with a median longitudinal pit (not always present), margin of area not beaded; legs slender but of normal structure, the basitarsi long; apices of femora broadly, and tibiæ and tarsi entirely, bright ferruginous; tegulæ ferruginous, punctured. Wings reddish hyaline, stigma and nervures ferruginous;

stigma extremely small; marginal cell long and narrow, obtuse at end; b. n. falling far short of t.-m.; second s.m. very broad, receiving first r. n. slightly beyond middle; third s.m. receiving second r. n. far from its end. Abdomen shining, finely punctured, with long hair which extends over the surface, but also forms rather distinct bands; apical plate very broad, truncate, with rounded corners.

Hab. Hermannsburg, Central Australia (*H. J. Hillier*; British Museum).

In the colour of the antennæ, &c., this is curiously parallel with *P. fimbriatus hillieri*, Ckll., from the same locality. The species may be compared with *P. fulvus*, Sm., *P. ruficornis*, Sm., and *P. waterhousei*, Ckll., but is very distinct by the structure of the metathorax, &c.

IV.—New South-American Arctiadae.

By J. J. JOICEY, F.L.S., F.E.S., and G. TALBOT, F.E.S.

THE types of the species herein described are all in the collection of Joicey.

Our thanks are due to Sir G. F. Hampson for help in the determination of the species.

Coloured figures of all these species will be published later.

1. *Thyrarctia semivitrea*, sp. n.

♂. Head, thorax, legs, and abdomen as in *cedo-nulli*, Stoll., white spot on tegulæ much smaller.

Upperside.—*Fore wing* chocolate-brown. A triangular hyaline patch at apex as in the allied species. A broad hyaline band crosses the wing and extends costally from before the base of vein 7 to middle of cell opposite vein 3, and along outer margin from vein 5 to just below termination of vein 2. This band is indented in cellules 5 and 6, and its proximal edge is straight. A thin waved dark brown submarginal line crosses the band, representing, as it were, the outer edge of a similar but much thicker line in the allied species. A pale irregular discocellular patch, the larger part of which lying outside the cell is bluish grey edged with yellowish, the part within the cell is mostly dark brown. The discocellulars are outlined with white, as is also the base of vein 5 within the discocellular patch. Costa cream-colour from apex to proximal border of hyaline band.

A pale bluish-white line runs from near base of vein 3 to inner margin and parallel to outer margin, and a similar line runs from 2 to inner margin near tornus; the lower triangular space formed by the crossing of the lines is nearly filled by a pale bluish-white suffusion. *Hind wing* as in allied species, but fringe entirely white.

Underside.—*Fore wing* similar to upperside, but basal half greyish white except a dark streak in cell and a dark patch in and below cellule 2. *Hind wing* thinly scaled with white, except costal area which is much more thickly scaled.

Length of fore wing 26 mm.

Type from Rentema Falls, Upper Maranon, North Peru, 1000 feet (*A. & E. Pratt*). One example.

2. *Prumala sulphurea*, sp. n.

Allied to *lophocampoides*, Feld.

♀. Upperside of *fore wing* sulphur-yellow, bearing greyish-white spots with a darker edging. Near base of cell a large spot tinged slightly with red, and a dot at extreme base on median vein; below cell a somewhat rounded spot divided by a red line; a small spot near upper angle of cell; a postdiscal row of small spots in 1 b-6, the ones in 3 and 4 more distally placed, the lower three directed basad; a second postdiscal row from inner margin to 7, the one at inner margin very large and tinged with red, the spot in 5 the next largest and darker than the others; a subterminal series of smaller spots of nearly equal size; a dark brown spot at apex and another below it. *Hind wing* yellowish white with a reddish tinge along inner margin; fringes pale yellow.

Underside of *fore wing* paler in basal area; the cell-spot, the spot in 5 of the second postdiscal row, and the two apical spots blackish brown and well defined; the large spot near the tornus pale red. *Hind wing* as above.

Antennæ blackish brown, grey-white at tips; palpi blackish brown, dull red on outside posteriorly; head and thorax sulphur-yellow; abdomen buff; pectus yellowish brown; legs grey-brown with femora fringed with yellowish-brown hair.

Length of fore wing 24 mm.

2 ♀ ♀ from Oconeque, Carabaya, S.E. Peru, 7000 feet (*G. Ockenden*).

3. *Neonerita yahuasæ*, sp. n.

♂. Upperside of *fore wing* brick-red, crossed by a post-

discal yellowish-white band, which cuts off a rounded apical area and extends along outer margin; distal edge of band deeply incurved and inner edge slightly so. *Hind wing* white, yellowish on the inner margin, cell washed with red.

Underside paler than the upperside.

Antennæ yellowish brown; palpi grey-white, red laterally; head yellowish white, vertex red; tegulae and patagia yellowish white marked with red; abdomen grey-white above with red dorsal spots on the two basal segments; pectus, legs, and abdomen white below.

Length of fore wing 11 mm.

1 ♂, Yahuas Terr., Upper Amazons, Peru.

4. *Aræomolis hæmatoneura*, sp. n.

Allied to *rhodographa*, Hamps.

♂. Upperside of *fore wing* grey-brown, veins striped with red, but 1 *a*, 1 *b*, 2, 10-12 only red in distal part. A sub-basal yellowish-white patch filling angle of median interspace and base of cell, also forming a small subcostal spot; a yellowish-white discal band from 1 *a* to 3, filling base of 2 and in 1 *c* merged into the subbasal band, traversed by a thick red angled line which forms a short stripe in 1 *b* and a loop at base of 1 *c*; a yellow spot at base of cellule 3, one near base of 4, a larger oblong spot on discocellulars, a small spot near base of 6, and a smaller one near base of 7; nervules in cell striped with red basally and distally; a sub-terminal band of three groups of spots marked with red—one at tornus in 1 *b* and 1 *c*, one in 3 and 4 and not reaching vein 5, a dot below 3, the third group of three spots in 5-7, the one in 6 the largest; marginal spots at ends of veins, those in 3, 4, and 6 being joined to the larger spots; some lighter grey scaling on each side of veins in postdiscal area. *Hind wing* crimson, paler costally; fringes whitish.

Underside of *fore wing* with basal and median area crimson-pink, the yellowish areas showing through from above; spots as above, but only faintly marked with red; veins striped with red, except costal; base of costa red. *Hind wing* yellowish in costal area.

Head ochreous yellow mixed with red; palpi red, third segment black; antennæ black, red at base; tegulae and patagia ochre-yellow with red fringes; thorax blackish brown with red dorsal and lateral lines; abdomen pale red above, greyish below; thorax pale red below; legs ochreous marked with grey-brown, tarsi red, grey-brown at extremity.

Length of fore wing 17 mm.

1 ♂, La Selva, San Juan, Choco slopes of Colombia, 4600 feet, Sept. 1909.

5. *Aræomolis guianensis*, sp. n.

Resembles the preceding species.

♀. Upperside of *fore wing* pale chocolate-brown speckled with grey-white along costa and along either side of veins, which are crimson. A creamy-white basal band, marked with crimson, not reaching costal margin and interrupted in cellule 1 *b*; a creamy-white discal band formed of two spots in cell, one in angle of 2, a large oblong spot in 1 *c* and a smaller spot in 1 *b*, a still smaller spot in 1 *a*; a postdiscal band of three white spots in 4, 5, and 6, the middle one the larger and more distally placed; a small triangular spot at base of cellule 7; a terminal series of creamy-white spots in 1 *b*-7, those in 3-6 oblong and larger than the others, spot in 5 the smallest. *Hind wing* crimson, paler costally.

Underside of *fore wing* paler than above, veins striped with crimson, some crimson suffusion in upper part of cell and in outer median area, bands and spots as above; fringes chocolate-brown, yellowish white at the veins. *Hind wing* as above.

Antennæ brownish, posterior half striped with crimson above; palpi grey-white, striped with crimson at sides; frons grey-white, edged with red in upper part; vertex creamy white, basal segments edged with crimson at apices; tegulae creamy white, edged with crimson, and bearing a crimson spot; patagia creamy white, fringed with crimson, and bearing a central crimson line; thorax probably creamy white or buff, the specimen being rubbed; abdomen pale crimson above, grey-white below; thorax grey-white below; legs grey-white, tarsi of anterior and intermediate pair with the two end-segments darker, anterior pair crimson on outside.

Length of fore wing 17 mm.

Hab. French Guiana, Sept. and May. Type from St. Jean du Maroni, Sept. 3 ♀ ♀.

6. *Parævia guianensis*, sp. n.

Allied to *methæmia*, Schaus.

♀. Upperside deep chocolate-brown. *Fore wing* with an oblong yellow costal spot, rounded posteriorly, filling middle of cell; a small yellow costal spot between this and an apical spot; a triangularly-shaped yellow patch on the

outer margin, limited anteriorly by vein 5 and narrowing to the tornus; a red dot on inner margin near tornus.

Underside of *fore wing* as above, but paler; *hind wing* with basal half pale yellow.

Antennæ missing; head and palpi ochreous, frons darker; thorax deep chocolate-brown; abdomen red above, ochreous below; legs ochreous.

Length of fore wing 9 mm.

1 ♀, British Guiana.

7. *Automolis metallica*, sp. n.

Allied to *Pseudoguapisa*, Roths.

♂. Wings dark chocolate-brown. Upperside of *fore wing* with a longitudinal yellow median stripe extending from near the base in the median interspace to cellule 5, twice as broad below vein 2 as above it, and not entering the cell; a yellow spot in cellule 6 near the margin; veins striped with yellow. *Hind wing* with costal half yellow, forming a straight edge below the cell.

Underside as above. *Hind wing* with costal yellow interrupted at middle, yellow area extended in median interspace.

Antennæ black; head, palpi, thorax, and base of abdomen dark chocolate-brown; palpi on outside yellow at base and apex; frons and vertex metallic blue, a yellow dot at base of antennæ; tegulæ and patagia yellow, edged with dark brown; legs dark brown, tarsi yellow, fore legs with end tibial segment yellow; abdomen deep brown with metallic-blue dorsal spots, three on segments 5-7, a lateral series of similar spots; basal area of ventral segments yellow, a yellow lateral basal patch.

Length of fore wing 17 mm.

In the co-type the stripe on the fore wing is much narrower and above vein 2 is represented by a faint line; the subapical spot is on vein 6 instead of in the cellule; the yellow basal patch is absent on the abdomen.

Hab. Chiriqui. 2 ♂ ♂.

8. *Melese costimacula*, sp. n.

Closely allied to *amastris*, Druce.

♀. The upperside of *fore wing* is reddish chocolate-brown and not so red as in *amastris*, without orange spots at the base. There are two crimson dots near base on submedian, one at extreme base of median and another at angle of submedian. An orange dot in the cell, heavily ringed with

crimson. In other respects and in size not different from *amastris* ♀.

Hab. La Selva, San Juan, Choco slopes of Colombia, 4600 feet, Sept., Oct., 1909. 2 ♀ ♀.

9. *Melese signata*, sp. n.

Closely allied to *russata*, H. Edw.

♂. Fore wing above darker brown than in *russata*. Basal area with irregular orange-red patches forming a basal, a median, and postdiscal series; the two first of three spots each, the anterior spot in the cell, outer row with anterior spot minute beyond end of cell; a white subcostal spot.

♀. Fore wing above with costa edged with crimson to apex; a yellowish-white costal lunule reaching below vein 5; crimson spots in basal area smaller than in ♂, postdiscal series and upper median spot absent; fringe orange, edged with crimson to vein 3, then blackish brown.

Size as *russata*.

Hab. Tabaconas River, N. Peru, 6000 feet (*A. E. & F. Pratt*). 3 ♂ ♂, 3 ♀ ♀.

10. *Melese nebulosa*, sp. n.

Allied to *flavimaculata*, Dogn.

♀. Upperside of *fore wing* dark brown, largely suffused with crimson except at distal margin, base, and basal two-thirds of costa; a crimson spot in cell above vein 2; a crimson and yellow subbasal patch between cell and inner margin, bearing a yellow spot above the submedian; close to this another similar patch, not reaching vein 2, and bearing a yellow spot above the submedian; in cellule 2, near cell, a rounded crimson spot ringed with yellow; between cell and apex, two subcostal spots in 5 and 6, the upper one yellow, the lower larger and almost white; a subbasal crimson spot on the median; the submedian edged with crimson to outer edge of subbasal patch, and inner margin yellow to same extent. *Hind wing* crimson, paler basally.

Underside of *fore wing* crimson-pink; costa from opposite vein 2 narrowly dark brown, apex broadly so and narrowing to the tornus; subapical spots as above. *Hind wing* pink.

Antennæ blackish, whitish at tips; head and palpi crimson, upper part of frons brown; tegulae and base of patagia yellow and crimson, patagia fringed with dark

brown; abdomen crimson-pink above, paler below; legs smoky brown, tarsi grey-white, coxæ and part of femora pink.

Length of fore wing 17 mm.

Type from San Gaban, S. Peru, 2500 feet, March and April, 1913. 1 ♀.

11. *Hyperthæma reducta*, sp. n.

Closely allied to *sanguineata*, Walk.

♂. The basal spot on fore wing is smaller and margin of the hind wing broader than in the allied species. The white area of the hind wing is well defined and fills the lower third of cell, extending to nearly half of inner margin, narrowing distally and forming a spot in 5 beyond cell.

♀. The basal spot on fore wing is only represented by a faint black dot and the distal spot is absent. The white area of the hind wing is narrower. The specimen from La Selva has the outer spot of the fore wing present, and the white area of the hind wing as in the ♂.

Size as in *sanguineata*.

Types from Siato, Rio Siato, slopes of Choco, Colombia, 5200 feet, Sept. 1909. Also 1 ♂ from La Selva, San Juan, slopes of Choco, Colombia, 4600 feet, Sept. 1909.

12. *Hyperthæma albipuncta*, Schs., ♂.

H. albipuncta, Schaus, Ann. & Mag. Nat. Hist. ser. 7, vol. vii. p. 265 (1901) (Brazil). ♀.

♂. Fore wing reddish. Hind wing white, thinly scaled, smoky brown at anal angle and at apex.

1 ♂ from Nivac, Matto Grosso, Brazil.

13. *Carathis tabaconas*, sp. n.

Distinct from other species of the genus.

♂. Upperside of fore wing chocolate-brown with yellowish-brown spots. Some irregular spots forming a basal patch; a small and darker median spot a little distally of origin of vein 2; a round spot in upper angle of cell; a subterminal spot in 3 and 4, its lower part whitish; a dot at end of vein 3; a rounded subapical patch, its outer part whitish and defined by a darker zigzag line; a rounded spot at apex. Hind wing hyaline; costa yellowish brown; inner margin slightly crimson, blackish at anal angle; fringes dark brown.

Underside similar to upperside.

Antennæ dark brown ; palpi yellowish, anteriorly brown ; frons dark brown ; vertex yellowish brown ; tegulæ yellowish brown ; thorax and dorsal surface of abdomen blackish brown ; abdomen crimson laterally and yellow below ; legs banded with yellowish brown and dark brown.

Length of fore wing 18 mm.

Hab. River Tabaconas, N. Peru, 6000 feet (*A. E. & F. Pratt*), 1912. 8 ♂♂.

14. *Pelochyta suffusa*, sp. n.

Allied to *umbrata*, Hmps., from Bolivia.

♂. Upperside of *fore wing* smoky brown, with paler and indistinct markings ; a broad and oblique postdiscal band from lower submedian to vein 6, close to this an outer straight line which is joined to the band in 3 and is wider in 4 and 5, a pale basal stripe in 1 *b*. *Hind wing* dark smoky brown, paler at base and with a yellowish tinge on inner margin.

Underside smoky brown, hind wing yellowish brown in basal part.

Palpi deep brown ; antennæ, head, and thorax smoky brown ; basal joint of antennæ yellow on outside ; abdomen yellow ochreous, dorsally smoky brown, paler at base ; pectus and legs smoky brown.

Length of fore wing 21 mm.

Hab. Rio Huacamayo, Carabaya, S. Peru, 3100 feet, vi. 1904 (*G. Ockenden*). 1 ♂.

15. *Elysius mediofasciata*, sp. n.

Allied to *francki*, Schaus, but distinguished by the post-discal and marginal bands on the fore wing.

♂. Upperside of *fore wing* dark brown, thickly irrorated with crimson and paler distally. A subbasal orange patch below the cell ; an orange spot in cell at vein 3 ; a pale orange postdiscal band at right angles to costa and not touching end of cell, curving inwardly from vein 5 to 3, touching cell in cellule 3, then curving outwards and not quite reaching 1 *a* ; a broad marginal border of pale orange, narrowing from vein 5 to apex, and ending in a point on vein 1 *a* ; a crimson patch at base below submedian. *Hind wing* hyaline with costa crimson and inner margin crimson to submedian.

Underside of *fore wing* crimson, paler in distal area. *Hind wing* as above, costa paler distally.

Antennæ blackish brown; head and palpi crimson; thorax crimson mixed with orange; abdomen orange above, dark reddish brown below, basal half crimson above, 4 black dorsal spots on segments 5-8, a lateral row of black spots; pectus crimson, coxæ and femora crimson, tibiæ and tarsi blackish brown.

Length of fore wing 27 mm.

Type from San Gaban, S. Peru, 2500 feet, March and April, 1913. 1 ♂.

16. *Hemihyalea hampsoni*, sp. n.

Distinct from other species in the genus.

♂. Both sides of wings sooty black, more thinly scaled in the discal areas.

Antennæ missing for the greater part, but apparently black, basal segment orange; palpi, head, and thorax bright orange; anterior segment of palpi black; abdomen deep black, anal tuft orange in middle; thorax below reddish orange, also coxæ, rest of legs black.

Length of fore wing 21 mm.

Type from French Guiana(?). 1 ♂.

17. *Neritos flavimargo*, sp. n.

Allied to *sardanapalus*, Roths., but not so dark.

♂. Upperside of fore wing deep crimson irrorated with blackish. A triangular costal spot extending across upper angle of cell and reaching below vein 5; apex and outer margin narrowly yellow, widening in cellule 3. Hind wing yellowish tinged with red.

Underside paler than above, with no dark irroration. Hind wing with only a faint red tinge.

Antennæ deep crimson, anterior third white; head and thorax deep crimson, greyish ochreous below, vertex yellow; abdomen crimson above, greyish white below; legs greyish ochreous.

♀. Fore wing with costal spot not reaching vein 5; yellow margin slightly wider in cellule 3.

Length of fore wing, ♂ ♀, 11 mm.

Type ♂ from Contamana, Rio Ucayali, Nov.-Dec.; ♀ from Rio Ucayali; 1 ♂ from Rentema Falls, Upper Marañon, N. Peru, 1000 feet (A. E. Pratt).

18. *Neritos cardinalis*, Dogn., ♀.

N. cardinalis, Dognin, Ann. Soc. Ent. Belge, xliii. p. 327 (1889) (Colombia). ♂.

♀ similar to ♂. On fore wing the yellow subbasal band

is narrower, the costal spot is broader, the spot above tornus constricted in cellule 3.

Rio Ucayali, Upper Amazons; also 1 ♂, Rio Marañon; 1 ♂, Contamana, Rio Ucayali, Nov.-Dec.

19. *Emilia castanea*, sp. n.

Distinct from other species of the genus.

♂. Upperside of *fore wing* chocolate-brown; three white subbasal spots in 1 *b*, 1 *c*, and on costa, a white oblong spot on costa just before upper angle of cell, a white costal dot near apex and another at extreme apex; fringes dark brown and bearing a white spot at end of vein 2. *Hind wing* smoky black and semihyaline, more thickly scaled on inner marginal area.

Underside of *fore wing* similar to upperside, yellowish white at base. *Hind wing* brown, a yellowish spot at base of costa, a small yellowish spot on costa near origin of vein 8.

Antennae dark brown; palpi yellow; head and thorax chocolate-yellow; tegulae pale yellow, edged outwardly with chocolate-brown and bearing a brown dot near base; abdomen black above, yellow below, with a lateral red stripe; pectus and femora yellow; tibiae and tarsi brown, banded with yellow.

Length of fore wing 15 mm.

Type from El Topo, Rio Pastaza, E. Ecuador, 4200 feet (G. Palmer). 1 ♂.

20. *Hyponerita hamoia*, sp. n.

♂. Upperside of fore wing greyish brown. A yellowish-white costal patch extending across end of cell and reaching origin of vein 3, outwardly rounded and broadened on costa; a yellowish-white spot at apex; a yellowish-white terminal border, widest in cellule 3 and very narrow above this vein: all these markings edged with a fine red line. *Hind wing* yellowish white with a faint red tinge on inner area.

Underside as above. Fore wing with band and median area greyish pink, base of costa red.

Antennae dark brown; palpi grey-brown; frons dark brown, vertex yellowish white; abdomen creamy above, grey-white below; pectus and legs grey-white.

Length of fore wing 15 mm.

Type from La Selva, San Juan, Choco slopes of Colombia, 4600 feet, Sept. 1909. The only example.

V.—*New Delias and other Butterflies from the East.*

By J. J. JOICEY, F.E.S., F.L.S., and G. TALBOT, F.E.S.

[Plates IV. & V.]

WITH the exception of the first-named, the types of the species herein described are in the collection of Joicey.

1. *Delias egialea horracki*, subsp. n.

This form is distinguished from *egialea*, Crm., from Java, by the strong reduction of the bluish-grey scaling.

♂. Upperside of *fore wing* black; basal half, from middle of costa to anal angle, powdered with bluish-grey scaling, this scaling being dense towards extremity of cell and above submedian nervure; an indistinct bluish-grey point at extremity of cell; a submarginal series of indistinct bluish-grey points. *Hind wing* black; basal half bluish grey to lower submedian, beyond this yellow.

Underside of *fore wing* black; a large greyish-white patch towards extremity and a double white spot at end of cell; three elongate greyish-white patches from cellule 3 to inner margin, the one in 3 the smallest; a submarginal series of whitish dashes. *Hind wing* black; subbasal red band, cell and two spots above bright yellow; a discal series of seven bright yellow patches, of which the last, in the lower median interspace, is much the largest.

♀. Upperside of *fore wing* blackish brown; outer half of cell, spot at extremity of cell, and three elongate patches below cell orange-yellow; submarginal series of indistinct and dull yellowish-grey spots. *Hind wing* blackish brown; outer half of cell, two patches above and one below the cell orange-yellow; basal half of inner marginal area whitish grey; bluish-grey scaling on inner part of cellular orange patch and above cell.

Underside of *fore wing* similar to male, but cellular and discal white markings more extended yellow. *Hind wing* as in male, but subbasal red band slightly larger.

Hab. Bawean. 2 ♂♂, 1 ♀ in the collection of Made-moiselle de Horrack, of Paris.

2. *Delias enniana kapaura*, Roths., ♂.

(Pl. IV. fig. 1.)

Delias enniana kapaura, Rothschild, Ann. & Mag. Nat. Hist. ser. 8, vol. xv. p. 178. no. 21 (Jan. 1915) (Kapaur). ♀.

♂. Upperside very similar to *enniana*, Ob. *Hind wing*

with black marginal border to above vein 4 a little broader and much better defined.

Underside of *fore wing* with broader triangular costal spot. The lower of the three apical spots is yellow in its upper part. *Hind wing* with basal yellow area darker and only faintly tinging cellules 4-6. The marginal border is wider and its edge straighter than in *enniana*.

Type ♂ from River Uty, North Dutch New Guinea, Jan. 1910 (*C. & F. Pratt*); 1 ♂ from same locality at 1500 feet, March 1910; 1 ♂, Upper Setekwa River, South Dutch New Guinea, 2000-3000 feet, vii.-ix. 1910 (*A. S. Meek*); 1 ♂, 1 ♀, Mount Misresi, Arfak, 3000 feet, Jan. 1910 (*C. & F. Pratt*).

3. *Delias dice eceicei*, subsp. n.
(Pl. IV. figs. 2 ♂, 3 ♀.)

Not having a true *dice*, Voll., before us, we compare this with *dorothea*, Mitis., the Waigeu form.

♂. Upperside of *fore wing* with edge of apical border outwardly curved at vein 4, the border narrower below vein 3 and only reaching submedian fold. *Hind-wing* border narrower, with a straighter edge, and not reaching vein 5.

Underside of *fore wing* with a narrow costal border and costal bar; spots in apical area larger and much as in *enniana*, Ob. *Hind wing* paler yellow than in *dorothea*, more thinly scaled in cellules 4-6, and leaving a narrow white edging to the marginal border above vein 4. Marginal border narrower, edge straighter, four small spots, the larger in 6.

♀. This specimen is probably from the Owen Stanley Range, but bears no locality, and we place it here provisionally.

Upperside as in *dorothea*, but hind wing with broader margin.

Underside of *fore wing* with broader costal bar almost united with distal border. Margin of hind wing much broader and with a nearly straight edge.

Hab. British New Guinea, Owen Stanley Range. (Type ♂, Elkeikei, 1500 feet, Jan.-Feb. 1903, *A. E. Pratt*; ♀, loc.?). In Tring Mus. a ♂ from Milne Bay.

4. *Delias dice samarai*, subsp. n.
(Pl. IV. figs. 4 ♂, 5 ♀.)

♂. Differs from *eceicei* in the less defined edge of the apical black on the *fore wing*. On the *hind wing* the margin is wider and extends beyond vein 6.

Underside of *fore wing* with much broader costal bar than in *eceicei*, and at its lower edge almost touching the apical brown; the costal border is also broader. The apex is more broadly brown, extending two-thirds along vein 4 and reaching the submedian fold; the second apical spot is rounded, the third shows no trace of yellow, the fourth and fifth are linear. *Hind wing* not paler than in *dorothea*, the edge of the marginal border evenly defined, and a series of five distinct subterminal yellowish spots; these spots are absent in one specimen.

♀. Resembles *dorothea*. Upperside of *fore wing* with reduced costal white bar; marginal brown broader between vein 3 and inner margin; basal dark suffusion reaching origin of vein 2. *Hind wing* with much broader marginal brown than in *dorothea* and *eceicei*; basal dark suffusion extended to origin of veins 7 and 2.

Underside of *fore wing* with costal bar joined to the apical brown; third apical spot tinged with yellow. *Hind wing* with the nearly straight edge of distal margin reaching origin of vein 4.

Hab. E. and S.E. British New Guinea. (♂ ♀ types, Samarai; also 2 ♂ ♂ Samarai.) In Tring Mus. 2 ♂ ♂; 1 ♀, Sariba Island.

5. *Delias albertisi neyi*, Ribbe, ♀.
(Pl. IV. fig. 6.)

Delias neyi, Ribbe, Insekten-Börse, xvii. p. 308 (1900) (Aroa River).
♂.

♀. Upperside of *fore wing* with reduced white area, which does not extend into cell. *Hind wing* with broader black margin.

Underside as in ♂.

Length of fore wing 34 mm.

Hab. British New Guinea, probably Yule Island.

The specimen bears the label "Amboine," which is certainly erroneous. There are two ♂ ♂ in the collection from Yule Island, but these do not differ from mainland specimens. In our series of five ♂ ♂ the discal spot of the hind wing is variable in size, and in one specimen from Yule Island it is absent.

6. *Eribæa eudamippus le moulti*, subsp. n.
(Pl. V. fig. 1.)

This form is intermediate between *nigrobasalis*, Lathy, *Ann. & Mag. N. Hist.* Ser. 8. Vol. xviii. 5

from Siam, and *rothschildi*, Leech, from China. It more resembles the former.

♂. Body as in *rothschildi*.

Upperside of *fore wing* with cell all black or bearing a pale streak. The spot at end of cell may or may not be joined to the patch in 3. The basal black is not so extended as in typical *nigrobasalis*, but is more so than in the specimen of that form from the Shan States figured in Nov. Zool. v. pl. xvi. fig. 2. The two inner submarginal spots in cellules 1*b*, 1*c* are either absent or the spot in 1*c* only is present and the spot in 1*b* represented by a bluish lunule. The subterminal spots are larger than in the allied forms, especially so in proportion is the spot in 7; there is a minute dot in 8 at the apex. *Hind wing* with some dark scaling at extreme base. The black marginal band is as broad as in *rothschildi* and with an evenly defined edge. The subterminal spots are a little smaller than in this form and the anal lobe is margined with yellow to half or more than half its width.

Underside more resembling typical *eudamippus* than *rothschildi*. On the hind wing the blue edging of the lunules is only faintly marked, the subterminal spots are smaller, and the silvery band is broken on the anal lobe by the extended yellow.

Hab. Vrianosong, Tibet. 6 ♂♂ sent us by Monsieur Le Moul, of Paris.

7. *Acca venilia jobina*, subsp. n.

(Pl. V. figs. 2 ♂, 3 ♀.)

♂ ♀. Approaches *pseudovenilia*, Fruh., from Dutch New Guinea, but the band is broader. On the *fore wing* the spot in the lower median space is smaller than the others, and the band is heavily margined with blue distally; the subapical spots are larger and closer together than in *pseudovenilia*. On the *hind wing* the band narrows anally and is heavily margined with blue distally.

1 ♂, 3 ♀♀ from Jobi.

A single ♀ from the island of Mioswar in Geelvink Bay may represent another race. It is much larger than other forms, the fore wing measuring 31 mm. The band is very broad, the spot in 2 on the fore wing measures 7 mm. and on the hind wing the band is 6 mm. wide at its middle. It is margined with violet-blue, though less heavily than in *jobina*. The subapical spots are very large.

8. *Papilio horishanus*, Mats. (Pl. V. fig. 4.)

We take this opportunity of figuring this very interesting *Papilio*. The specimen figured was taken at Gokansan, Formosa, in August 1914.

This distinct species shows its relationship to *kuehni*, Honr., from Celebes, in the delicate carmine patch on the hind wing below, this patch in *kuehni* being small and restricted to the discal area.

EXPLANATION OF THE PLATES.

PLATE IV.

- Fig. 1. *Delias enniana kapaura*, Roths., ♂.
 Fig. 2. — *dice ecceici*, ♂.
 Fig. 3. — — —, ♀.
 Fig. 4. — — — *samarai*, ♂.
 Fig. 5. — — —, ♀.
 Fig. 6. — *albertisi neyi*, Ribbe, ♀.

PLATE V.

- Fig. 1. *Eribœa eudamippus le moulti*, ♂.
 Fig. 2. *Acca venilia jobina*, ♂.
 Fig. 3. — — —, ♀.
 Fig. 4. *Papilio horishanus*, Mats.

VI.—On the Rats usually included in the Genus *Arvicanthis*.

By OLDFIELD THOMAS.

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THE variation in colour-pattern among the rats commonly included in the genus *Arvicanthis* is so great that one would expect that some generic or subgeneric division of them would prove ultimately advisable. Some species are without lines on the back, some have one, others four, and others again a larger number of stripes which may or may not be broken up into spots.

Of names already existing within the group the earliest is *Rattus*, Donovan, but, as is shown in a succeeding paper, that is antedated by earlier writers for other animals. Then follow *Arvicanthis*, Lesson, and *Isomys*, Sundevall, both based on the Nile rat, *A. niloticus*, and finally *Lemniscomys*, Trouessart, founded on the striped species, *L. barbarus* being taken as typical. Recently Mr. Heller* has recog-

* Smiths. Misc. Coll. lix, no. 16, p. 12 (1912).

nized *Lemniscomys* as a genus for the "striped or spotted" forms, but, working only from E. African material, he has exaggerated the degree of difference occurring in the zygomatic plate of the skull, nor has he mentioned the *pumilio* group, which in that respect agrees with *Arvicanthis*.

A careful examination of the Museum material shows that three quite distinct genera may be distinguished, whose characteristics are as follows :—

ARVICANTHIS, Less.

Syn. *Isomys*, Sund.

Type. *A. niloticus* (*Mus niloticus*, Geoff.).

Back generally without stripes, but sometimes with a single mesial one, not very sharply defined. Fifth finger normal in length, with a distinct sharply pointed claw.

Skull stout and heavy. Anterior zygomatic plate high, its top at about two-thirds the height of the muzzle, its anterior edge not or little cut back below.

Teeth stoutest of the group. Molars heavy, simple, the laminae transverse and little folded ; in m^3 the main lamina is slightly slanted, thicker externally, but not folded on itself.

These are the ordinary members of the "*niloticus*" group, known by their heavy form and generally unstriped coloration. A paper on their species and subspecies has been recently published by Mr. Dollman*.

LEMNISCOMYS, Trouess.

Type. *L. barbarus* (*Mus barbarus*, Linn.).

Body striped and often spotted as well, the median line of the back always black. Fifth finger shortened, with a short nail instead of a claw.

Skull rather more lightly built than in *Arvicanthis*. Anterior zygomatic plate low, the top only about half the height of the muzzle, its front edge generally undercut and concave, sometimes sharply so.

Molars smaller than in *Arvicanthis*, their laminae less simply transverse, more bent backward internally. Main lamina of m^3 strongly bent back on itself externally ; cleft

* Ann. & Mag. Nat. Hist. (8) viii. p. 334 (1911). In this paper *A. rex*, Thos., is put aside "as its affinities are very doubtful." In this conclusion Mr. Dollman's opinion is confirmed by my present observations, for the type of *rex*, unlike all members of true *Arvicanthis*, proves to have a nail instead of a claw on the fifth finger. It may be provisionally considered as a giant member of *Desmomyys*, Thos.

separating its tip from the small third lamina (whose large axis is transverse) deep, so that the two only become connected in old age.

Lemniscomys contains the great mass of the striped and spotted rats of Africa. The better-known species like *barbarus* and *striatus* are profusely striped and spotted, while, on the other hand, in the *spinalis** group there is only a single median dorsal line, and it seemed natural to expect some superspecific difference to be present between the two. But not only are they identical in all structural characters, but even in coloration certain of the rarer species practically link up the two extremes. Thus in *L. striatus venustus* the lateral light spots are less developed than usual, and in *L. linulus*, while present, they are so reduced that the species was described as being specially related to *L. "dorsalis."* And, finally, E. African forms described as subspecies of the same animal have a strong suspicion of lateral spotting. There is therefore a practically complete intergradation from one end of the series to the other.

RHABDOMYS, gen. nov.

Rattus, Donovan, 1827; nec G. Fisch. 1814; nec Desm. 1822.

Type. *R. pumilio* (*Mus pumilio*, Sparrm.).

Build lighter than in *Arvicanthis*. Back distinctly dark-lined, but the median line light instead of dark, with two dark lines on each side of it, making four in all; the number of dark lines is therefore even instead of odd. Fifth finger normal, with a claw.

Skull comparatively lightly built, somewhat bowed in the frontal region. Zygomatic plate not concave anteriorly.

Molars small, far lighter than in *Arvicanthis*, their structure essentially as in *Lemniscomys*, the laminae similarly bowed, or even a little more so. Main lamina of *m*³ strongly bent round on itself externally, and, owing to the shallowness of the notch behind it, it is very early joined to the posterior element of the tooth, which is round or longitudinally oval.

The *pumilio* group form a very distinct genus, characterized as above detailed. Even in coloration, although

* The well-known animal usually called *Arvicanthis dorsalis* unfortunately needs a new name, as Smith's *Mus dorsalis* of 1845 is invalidated by G. Fischer's use of the same name for a *Sicista* in 1814 (Zoogn. iii. p. 66). I would propose to replace *dorsalis* by *spinalis*, but this would only stand as a subspecies of *griselda*, Thos., the senior of the various subspecific names which have been added to *dorsalis*. The proper name of the South-African subspecies would therefore be *Lemniscomys griselda spinalis*.

striated, the striation is essentially different from that in *Lemniscomys*, the middle line here being light with an even number of black lines external to it, while in both *Lemniscomys* and, if a line is present, in *Arvicanthis*, the middle line is black, thus altering the whole pattern.

So far as is known, there are four definite dark lines in all the species of *Rhabdomys*, no variation in the number or continuity of the lines occurring in the genus. But in desert forms, such as *R. p. bechuanæ*, they are considerably reduced in intensity.

A paper on the forms of *Rhabdomys* was published by Mr. Wroughton in 1905*.

VII.—On *Rattus* as a Generic Name, with a Note on the Nomenclature of *Echimys* and *Loncheres*. By OLDFIELD THOMAS.

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IN Palmer's 'Index Generum Mammalium,' 1904, the standard work on mammalian generic names, *Rattus* is first quoted (p. 601) as from Frisch, 1775, and then (p. 602) as from Donovan, 1827, with a note to the latter that it "is entitled to recognition if *Rattus*, Frisch, 1775, is not a valid name." Palmer also notes that *Rattus*, Zimmerman †, "is not generally regarded as a valid generic name," a conclusion with which I concur. Frisch's names are also now refused recognition ‡, and therefore the question arises as to the animal to which, if any, the name *Rattus* is applicable.

Palmer's, and later on Miller's, belief that Donovan's use of the name is the first valid one does not prove to be correct, for it was used in valid form by Desmarest in 1822 (Mamm. ii. pp. 297–300). Though placed in the synonymy of *Mus*, its type, settled by tautonymy, would clearly be *Mus*—or, as now called, *Epimys*—*rattus*, Linn.

Fortunately, however, I have been able to find a still earlier use of the name, which does not upset, as Desmarest's would, the now widely used *Epimys*, but falls on a rare and little-known Paraguayan animal, the "*Rat épineux*" of Azara.

* Ann. & Mag. Nat. Hist. (7) xvi. p. 629.

† Spec. Zool. Quadr. p. 344 (1777).

‡ Cf. Thomas and Miller, Ann. & Mag. Nat. Hist. (7) xvi. p. 461.

The reference is as follows :—

“2. *Rattus spinosus*, le rat épineux, d’Azara, vol. ii. p. 73, longitudine 10 pollicum, . . .”*.

Even though it might be claimed that the combination was meant for a mere translation of Azara’s name, in form it is so correct and so similar to the “1. *Hystrix macroura*” and “3. *Hystrix chrysura*,” that precede and follow it, both undeniably meant for generic and specific names, that I consider we are justified in regarding it in a similar light, and therefore as a valid founding of the generic name *Rattus* on the species *spinosus*.

It is to be hoped that no earlier reference will be found, as should such occur it will in all probability prove to be based on *Mus rattus*, Linnæus, and will therefore upset *Epimys*. But after considerable search I have failed to find anything earlier than Fischer’s fortunate reference to Azara’s animal.

The application of *Rattus* among the Octodontidæ has next to be considered, but attention must first be drawn to the much-discussed question of what species is the type of *Echimys*, F. Cuv., 1809. Of the two species originally included in it, the “Lerot à queue dorée” and the “Rat épineux de d’Azara” (i. e., *Loncheres chrysurus* and *Echimys spinosus* of recent zoologists), Dr. Allen, in 1899 †, fixed upon the latter as the type, on the ground of elimination, and this selection has been generally followed. But, unfortunately, in a book to which Mr. Gerrit Miller has recently directed attention, Fleming’s ‘Philosophy of Zoology, 1822 ‡, “*Hystrix chrysurus*” is selected as the type of *Echimys*, and I fail to discover any means of upsetting this selection, which is exactly on all fours with that of *Sciurus volans* as the type of *Pteromys*, about which Mr. Miller wrote.

If, then, as we are compelled to do, we accept Fleming’s selection, the name *Echimys* will become the correct term for the animals usually known as *Loncheres*, with *Echimys chrysurus* as the type, while the genus typified by Azara’s *Espinoso* will have to bear another title.

For this latter the name *Rattus*, which has at least the merit of being short, will be available, antedating Goeldi’s *Euryzygomatomys* § by many years. Its two species are *Rattus spinosus* and *R. laticeps*.

* G. Fischer, Zoogn. iii. p. 105 (1814).

† Bull. Am. Mus. xii. p. 262.

‡ Vol. ii. p. 191.

§ Bol. Mus. Paraense, iii. p. 179 (1901).

By a curious and fortunate accident, the nomenclature of the genera in Trouessart's 'Supplement' * proves now to come out practically correct, *Echimys* being there used for the "*Loncheres*" group, while *Rattus* is called *Euryzygomatomys*. The use of *Echimys* is quoted from Allen, and must therefore have been due to a misunderstanding of the latter's paper, in which he came to quite a different conclusion. But the result is none the less convenient.

VIII.—*On the Generic Names applicable to the Chevrotains*
(*Tragulidæ*). By OLDFIELD THOMAS.

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THE name *Tragulus* was first published by Brisson †, who included in it four species. Of these the first, *Tragulus indicus*, "*Le Chevrotain des Indes*," was selected by Merriam ‡, when writing a paper on Brisson's genera, as the genotype, and this selection we may accept. But the belief that the *Chevrotain des Indes* was the Chevrotain of India in the modern sense—that is to say, the spotted *Tragulus meminna*—appears to me to be erroneous, and this is very fortunate, for had it been so some confusion and altering of names would have resulted.

For since the *Meminna* is at least subgenerically distinct from the other Oriental *Traguli*, a new name would be needed for the latter if the former were the type of *Tragulus*, while the *Meminna* has already got a special name.

On looking up Brisson's description, we find that all his quotations are of early accounts of the Royal Antelope, *Neotragus pygmaeus*, which at first suggests the misfortune of *Tragulus* itself being applicable to that animal and not to the Chevrotains at all. But Brisson's description is that of a Chevrotain, not of an antelope, as the possession of

* Cat. Mamm. Suppl. p. 503 (1905).

† Règn. An. (2) p. 12 (1762).

‡ Science, i. p. 375 (1895). Only the first line of Merriam's statement about *Tragulus* can be accepted, his assertion (based on the synonymy) about the identity of *T. indicus* being fortunately incorrect. As indicated by the double asterisk attached to the title, Brisson's *Tragulus indicus* was described from actual specimens examined by himself, and therefore takes precedence of his synonymy.

canines indicates with certainty, and further examination shows that the account is based on Buffon's "Chevrotain," of which he evidently saw the original specimens—colours, dimensions, and tooth-characters all being in agreement with those in Buffon's work. We may therefore eliminate the synonymy in Brisson, and accept the description as indicating the genotype of *Tragulus*.

The animal thus described is clearly one of the unspotted group related to *T. javanicus* or *napu*, but which species is immaterial for our present purpose. Certainly it is not the Indian *T. meminna*.

For the subgenus containing the latter, the name *Memina* or *Meminna* (Gray) is unavailable, having been earlier used by G. Fischer for an opossum*.

But *Moschiola*, first published invalidly by Hodgson in conjunction with a *nomen nudum*, may be taken technically from the synonymy given by Gray of his genus *Meminna* in 1852†, and will be available as a subgeneric name for the Spotted Chevrotain, which I should therefore call *Tragulus* (*Moschiola*) *meminna*.

Lastly, for the West-African Water-Chevrotain I should now use *Hyemoschus*, as, apart from its different geological horizon, it is sufficiently distinguished from *Dorcatherium* by its different premolar formula.

IX.—On Two new Carnivores from Asia Minor.

By W. F. GRIFFITT BLACKLER, M.A., F.Z.S.

THE British Museum contains specimens of a wild cat and a badger from the region near Trebizond which do not appear to have been described.

Felis sylvestris trapezia, subsp. n.

Resembling *Felis sylvestris caucasica*, but distinguishable by the smaller size of the skull.

Colour.—General colour approaching the broccoli-brown of Ridgway, with four black longitudinal lines on head and nape of neck, two being continued on to the shoulders, where they lie on either side parallel to a black median dorsal line which commences near nape and continues almost to base of

* Zoogn. iii. p. 611 (1814).

† Cat. Ungulata, p. 246 (1852).

tail. Markings on flanks nearest in colour to the sepia of Ridgway, appearing as three transverse stripes on the fore part and as oval or rounded patches on the hinder region. Stripes on the hind legs fairly well marked. Tail with black terminal portion and at least four black annulations of about 1 cm. each in breadth. Ears tinged with reddish brown, which is more conspicuous near the tip, and have a pointed tuft of black hairs projecting from the tip about 12 mm. long. Sooty patch at elbow apparent, but not so marked as in *F. s. caucasica*. Underparts similar to colouring of the *Felis sylvestris* group. Underfur of back and sides mauvy grey basally, the distal half ochraceous buff. Long hairs whitish at base, passing into black, with a cream-buff annulation at or near the tip, most of the hairs ending in black.

Skull.—Resembles that of *F. s. sylvestris* and *F. s. caucasica*, but is smaller. The mastoid breadth is conspicuously narrower, the nasals are more or less considerably constricted at a point midway in their length, and the auditory bullæ are more evenly rounded (although of same size and inflation) than in the other two allied subspecies.

Dimensions of the type (as measured in the flesh):—

Head and body 530 mm. ; tail 305 ; hind foot 133 ; ear 60.

Skull : condylo-basal length 86.2 ; basal length 78.2 ; zygomatic breadth 66.8 ; rostral breadth over canines 24.8 ; interorbital breadth 18.0 ; breadth of brain-case 43.0 ; mastoid breadth 38.2 ; palatal length 35.0 ; palatal breadth (measured across to inner edge of molar alveoli) 32.2 ; length of nasal suture 20.8.

Teeth : length of pm^3 and pm^4 17.0 ; maxillary tooth-row 30.3 ; three lower cheek-teeth 20.0 ; lower molar 7.9. All teeth moderately worn.

Hab. Khotz, near Trebizond (North-eastern Asia Minor). Alt. 500'.

Type. Old male. B.M. no. 6. 5. 1. 28. Original number 2337. Collected on 17th January, 1906, by A. Robert, and presented to the Museum by Oldfield Thomas, Esq.

Other specimens examined.—Three, all from the same locality.

This wild cat is similar to *Felis sylvestris sylvestris*, but the general colour is darker and more smoky-looking, and does not present such a clear appearance as does that of the latter. In this respect it approaches more nearly to *Felis sylvestris caucasica*, of which the British Museum possesses a very good specimen which agrees in skull-measurements with those

given by Satunin in his description of this subspecies. But it differs from this one in the much smaller size of its skull and in having the transverse stripes on the flanks only occurring in the anterior region, where three stripes are distinguishable, while in the posterior region the stripes tend to become broken up and appear as distinct oval or rounded spots, presenting also in this respect a distinctive difference from both *F. s. sylvestris* and *F. s. caucasica*, where the markings of the flanks preserve the striped character more or less along the whole side of the body. The ears of this cat have also a very marked pointed tuft of black hair at the tip, which also helps to distinguish it. The curious constriction of the nasal bones and the narrow breadth between the mastoid processes, together with the smaller size of the skull, besides the difference in the body-markings, fully justify ranking this cat as a new subspecies.

The skull of *F. s. caucasica* in the British Museum has a condylo-basal length of 94 mm., while the lengths of the three complete skulls from Khotz are 86·2, 83·0, and 81 mm. respectively.

Meles meles ponticus, subsp. n.

Superficially resembles *Meles meles*, but differs from the two subspecies as described by Miller in having more inflated auditory bullæ and in the size and shape of the upper molar.

Colour.—Generally similar to *Meles meles*, back and sides presenting a coarse grizzle of black and buff or buffy white; the black predominating on dorsal side, flanks showing more of the lighter colour. Hairs on back buff or whitish buff at bases, with a black band for their distal third part, and terminating with a whitish tip of about 5 mm. long. Underfur generally of darker buff than long hairs. Face and chin white, with a dark black-brown band on either side of face beginning behind nostril-pad, and extending backwards including eyes and ears to about middle of neck, where it fades into colour of back. Ears black-brown, anterior edge white. Underparts and all four legs dark brown to black-brown. Tail shorter proportionately than in *M. meles*, bushy, coloured like back at base, but fading into dirty buffy white.

Skull.—Comparing this with a range of skulls of *M. meles meles* and *M. meles marianensis* (*mediterraneus*, Barr.-Ham.), the salient points of difference are that the auditory bullæ are slightly larger and very considerably more inflated and rounded, the longitudinal inner ridge as described by Miller *

* 'Mammals of Western Europe,' p. 345.

being more or less completely lost through the inflation. The meatus is directed downwards and backwards from without to within, the plane of backward direction being more oblique to a line drawn at right angles to a median antero-posterior line on the skull than in the other two allied forms. The zygomata, even in the old specimens, are much thinner and more slender generally along their whole length.

Teeth.—The upper molar is larger than in *M. meles meles*, and of about the length of *M. meles marianensis*, but is narrower in proportion to its length, exhibiting in a number of specimens a mean ratio of 1 to 1·27 instead of 1 to 1·16–1·18 as in *M. meles meles* or 1 to 1·22 as in *M. meles marianensis* *. It further shows a marked bend or constriction midway along the inner edge between the inner anterior and posterior cusps, so that the least width across the tooth between the inner and outer anterior and posterior cusps is, on an average, about 1 mm. less than in the other two allied types.

(For comparative measurements, see table on opposite page.)

Dimensions of the type (as measured in the flesh):—

Head and body 660 mm.; tail 132; hind foot 105; ear 50.

Skull: greatest length 133·0; condylo-basal length 127·0; basal length 115·5; zygomatic breadth 78·0; interorbital breadth 28·4; palatal length 69·3; mastoid breadth 61·0; width of brain-case 54·6.

Upper molar: length along inner margin 15·4; breadth across the anterior cusps 12·1; least width across tooth at constriction between anterior and posterior cusps 11·2.

Hab. Scalita, 30 miles S. of Trebizond, North-eastern Asia Minor. Alt. circ. 3000'.

Type. Young adult male. B.M. no. 6.3.6.219. Original number 2208. Collected by A. Robert, 2nd Dec., 1905, and presented to the Museum by Oldfield Thomas, Esq.

Other specimens examined.—Three, all from same locality. Head and body 710, 660, 600; tail 152, 125, 110; hind foot 100, 80, 100; ear 40, 50, 43 respectively, measured in millimetres. Skulls all exhibit the typical characteristics.

This badger, though similar in colouring to the European forms, is immediately distinguishable by its large and inflated auditory bullæ and by the size and shape of the upper molar.

The following table of comparative measurements with a number of specimens of *M. meles meles* and *M. meles marianensis* may be of interest:—

* In this respect it approaches *M. meles canescens* (Blanf.) and *M. meles minor* (Sat.), of which the ratio is about 1 to 1·35, but the general colouring is different and it is a much larger animal.

B.M. number.	Sex.	Upper molar.	Least width of upper molar.	Lower molar.	Ratio of length to breadth in upper molar.	Condition of teeth.
<i>M. meles ponticus.</i>						
6. 3. 6. 219 (type)	♂	15.4 × 12.1	11.2	16.0 × 7.9	} 1 : 1.27	Not worn.
6. 3. 6. 220	♂	15.0 × 11.9	10.8	16.9 × 7.9		"
6. 3. 6. 36	♂	15.3 × 11.9	10.6	15.5 × 7.9		Moderately worn.
6. 3. 6. 35	♂	15.0 × 11.9	10.7	16.4 × 7.9		Slightly worn.
<i>M. meles meles.</i>						
8. 7. 15. 5	♀	14.0 × 12.0	11.9	16.2 × 7.2	} 1 : 1.18	Slightly worn.
11. 4. 3. 2	♂?	14.5 × 12.3	11.7	17.0 × 8.0		Not worn.
8. 11. 2. 16	♀	14.8 × 12.8	12.0	16.2 × 7.8		Slightly worn.
95. 12. 3. 1	♂?	15.6 × 12.8	11.6	17.0 × 7.8		Moderately worn.
<i>M. meles marianensis.</i>						
8. 7. 7. 19	♂	15.2 × 12.6	11.7	17.4 × 8.6	} 1 : 1.22	Moderately worn.
95. 3. 3. 7	♂	15.0 × 12.0	11.9	16.6 × 7.8		Slightly worn.
8. 3. 8. 6	♂	16.4 × 13.2	12.6	17.8 × 8.0		"
8. 3. 8. 7	♀	14.8 × 12.0	12.0	17.6 × 8.2		"
95. 3. 3. 8	♀	14.6 × 12.6	11.9	16.8 × 8.2		"

X.—On *Two new Subspecies of Roedeer*.
By W. F. GRIFFITT BLACKLER, M.A., F.Z.S.

WHILE working at a number of specimens of roedeer obtained in 1906 in North-eastern Asia Minor, and comparing them with all the other specimens in the possession of the British Museum, I have been led to the conclusion that they present sufficient characteristics to merit being classed as a separate geographical race, and therefore propose giving them a new name. At the same time I have been able to examine closely a number of roedeer from France which were obtained by the Museum subsequent to the time when Mr. Miller worked on the group in preparing his 'Catalogue of the Mammals of Western Europe,' although some were provisionally included under *Capreolus capreolus capreolus* at the last moment before going to press. These French roedeer appear so distinct in their general colouring from any of the other described forms, the difference being constant in all five individuals examined, that it seems quite justifiable to class them also as a new form.

Capreolus capreolus armenius, subsp. n.

Colour.—In winter pelage considerably darker and more smoky than either *Capreolus c. capreolus* or *C. c. transylvanicus*, showing hardly any trace of yellow tinge as in the former, the general colour approaching the sepia of Ridgway. The colouring of the back is not unlike that of *C. c. thotti* from Scotland, but that animal is readily distinguished from this by the fact of the head and neck being darker than the body. The middle part of the back is much darker than the flanks, this darker area commencing just behind the ears and extending backwards along the middle dorsal region to the tail, with a tendency to broaden out on the rump. Face and ears similar to colour of flanks, but slightly greyer. Inner side of ears almost white, the hairs on the anterior edge being quite white. Throat-patch and neck-patch well defined, the hairs being tipped with white. Colouring of underside almost as dark as in *C. c. thotti*, but bases of hairs much lighter. Hairs all over the body generally much shorter than in *C. c. capreolus*, measuring only about 25 mm. in length on the back at the shoulder, and their basal colour is the same, but the cream-buff annulations are shorter, rarely

exceeding 3 mm. Legs darker and tending to show more of the grizzled character of the back than in the other European forms. The older specimens have a whitish streak on the outer posterior side of the fore legs, extending from just below the elbow to about 4 cm. above the metacarpal joint.

Skull.—Principally characterized by its shortness and the bluntness of the muzzle as compared with *C. c. capreolus* and *C. c. transylvanicus*. The posterior ends of the nasals are more rounded and do not stretch so far back as do those of the other forms in relation to a line drawn across the skull at the most anterior edges of the orbits.

Hab. Sumela, 30 miles south of Trebizond, N.E. Asia Minor. Alt. circ. 3500'.

Type. Female. B.M. no. 6. 3. 6. 188. Original number 2136. Collected 8th November, 1905, by A. Robert, and presented to the Museum by Oldfield Thomas, Esq.

Dimensions (as measured in the flesh) :—

Head and body 1080 mm.; hind foot 330; ear 125.

Skull: greatest length 189; condylo-basal length 180; greatest breadth 87·2; interorbital breadth 50·0; length of nasals 48·8; gnathion to orbit 95; gnathion to tooth-row 55·6; maxillary tooth-row 58·0; length of molar series 34·5.

Capreolus capreolus joffrei, subsp. n.

Colour.—The back presents the typical grizzle, but the general colour is very much yellower and warmer in tone, almost approaching to Ridgway's "mummy-brown," the light annulations being much more tawny than in *C. c. capreolus*. A well-marked darker area along the middle of the back. Throat- and neck-patches evident, but not clearly marked. White area in tail-region considerably reduced. Underside more tawny-coloured than in the allied forms. Face and ears much greyer than body. Hairs on back about 40 mm. in length.

Skull.—The skull does not exhibit any particular cranial peculiarity, except that it is shorter and smaller than the three described continental subspecies, and in this respect, as well as in general appearance, it greatly resembles that of the British form.

Hab. France. Type from Ferrières, near Paris.

Type. Male. B.M. no. 12. 1. 17. 1. Original number T. V. S. 644. Collected 23rd December, 1911, and presented to the Museum by the Hon. N. C. Rothschild.

Dimensions of type:—

Head and body 1040 mm. (circ.); hind foot 298; ear 122.

Skull : greatest length 179.0 ; condylo-basal length 173.0 ; greatest breadth 84.6 ; interorbital breadth 54.4 ; length of nasals 52.2 ; gnathion to orbit 92.0 ; gnathion to tooth-row 53.3 ; maxillary tooth-row 59.6 ; molar series 34.3.

This roedeer can be readily distinguished from the other European forms by the decided tawny-yellow colour of the winter pelage.

XI.—*A new Loricariid Fish of the Genus Cyclopium from Ecuador.* By C. TATE REGAN, M.A.

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Cyclopium mindoense, sp. n.

Length of head 4 in the length of fish. Interocular width equal to distance from eye to posterior nostril, 4 in the length of head. Nasal flap produced into a barbel ; maxillary barbel extending to base of pectoral ; teeth acute, those of outer series of præmaxillaries unicuspid except 3 or 4 median teeth, which are bicuspid ; mandibulary teeth bicuspid. Anterior ray of dorsal a little longer than head ; outer ray of pectoral produced, nearly $\frac{1}{3}$ length of fish ; outer pelvic ray as long as anterior ray of dorsal. Adipose fin elongate, extending on to caudal fin, with a well-developed spine that extends to its free margin, but tapers off below, and appears not quite to reach its base ; spine separated from caudal by a space equal to $\frac{1}{4}$ the length of the middle rays of that fin. Anus equidistant from vertical through origin of dorsal and last ray of anal, its distance from first ray of anal $\frac{1}{6}$ the length of the fish. Distance from snout to origin of dorsal fin $2\frac{2}{3}$ in the length of the fish, from last ray of anal to caudal 7. Body with irregular dark spots ; anal and caudal dark at base ; caudal also crossed by a dark bar.

A single specimen, 65 mm. in total length, from Mindo, Western Ecuador, collected and presented to the Natural History Museum by Mr. W. Goodfellow.

This species is related to *C. cirratum*, Regan (P. Z. S. 1912, p. 670), from Western Colombia, which differs especially in the more posterior position of the vent (scarcely nearer to vertical through origin of dorsal than to base of caudal, separated from anal fin by a distance equal to $\frac{1}{9}$ the length of the fish), and in the more normal structure of the spine of the adipose fin. *C. ventrale*, Eigenmann (Indian Univ. Bull. x. 1912, no. 8, p. 15), is, as Eigenmann thought likely, a synonym of *C. cirratum*.

XII.—A Revision of the "Cribrimorph" Cretaceous Polyzoa.

By W. D. LANG, M.A., F.Z.S.

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Introductory.

A very large number of the Cretaceous Polyzoa, usually placed in *Cribrilina* and similar genera, fall into the groups here described. Though it is possible that some of the subdivisions of these families may eventually prove to be unrelated, yet within these subdivisions the general evolutionary history is so plain, and marches so agreeably with the horizontal distribution of the forms, that there can be no doubt that the grouping is mainly natural.

Before dealing with the families in detail, it is well to review their common structure and the evolutionary aims common to all. Like all fossil Polyzoa, each form here described is a colony (*asty**) composed of individuals (*æcia**) incrusting other objects in free unilaminar or bilaminar sheets, in cylindrical tree-like forms, or sometimes in multilaminar masses. The *æcia* are *Cribrimorphs* † and *Steginomorphs* †, and are derived from *Membranimorphs* † or Cheilostome Polyzoa with a box-like *æcium* of which the uppermost side (*front wall*) has on it an oval rim (the *termen* ‡) which may, or may not, be beset with spines. The *termen* includes the *aperture*. Outside the *termen* the skeleton is calcareous, within it is chitinous. The *Membranimorphs* which directly gave rise to *Cribrimorphs* had a spiny *termen*, and of the terminal spines one pair proximal to the *orifice* fuses across the middle line and forms the *apertural bar* †. The terminal spines distal to the *apertural bar* (the *apertural spines* †) are typically six in number, but may be reduced to four and occasionally exceed six. It has not been possible to determine whether the pair of terminal spines which form the *apertural bar* are in every case homologous, but it is nearly certain that this is so within a given family or subfamily. The evolutionary history of the *apertural spines* is varied. The terminal spines proximal to the *apertural bar* are called *costæ* and, leaning over the intra-terminal space,

* The colony is generally spoken of as the *zoarium* and the individuals as *zoæcia*. For clear thinking, it is more convenient to have precise terms, as here used, for the skeletal parts as opposed to the zoarium and zoecium, which strictly apply to the body-wall as well as its secretions.

† For these terms, see Lang, 1916, *Geol. Mag.* dec. vi. vol. iii. p. 76.

‡ For this term, see Lang, 1914, *Geol. Mag.* dec. vi. vol. i. p. 6.

they fuse in the middle line to form a calcareous, more or less perforate, intraterminal front wall. Such forms are Cribrimorphs.

The evolutionary aim in the development of all families appears to be the disposal to the best advantage or least detriment to the organism of superfluous Calcium Carbonate*. Doubtless, the ancestral Membranimorphs secreted the terminal spines under this stimulus. Continued pressure led to the exaggeration of the spines, and these, by bending over and fusing with their opposing fellows, formed a median line of fusion which gave scope for a considerable deposition of Calcium Carbonate.

Henceforward the disposal of Calcium Carbonate takes place in three main directions, which may be simultaneously pursued during the evolution of any one lineage. The intraterminal front wall tends to become more solidified by means of lateral fusions between the costæ, and secondary Calcium Carbonate may be piled up on the median line of fusion. The distal apertural spines may thicken and fuse with each other or with secondary tissue outside them to form the *distal shield* of secondary aperture, while thickenings or processes of the apertural bar, often helped by fusions with avicularia or with the proximal pair of apertural spines, form the *proximal shield* of a secondary aperture. And, thirdly, interœcial tissue may envelop the front wall peripherally or group itself around interœcial avicularia and, growing up, leave the intraterminal front wall sunk at a lower level. The secondary aperture may continue to grow in a tubular form, or may spread laterally and, by meeting and fusing with the outgrowths of neighbouring secondary apertures and interœcial tissue, may form a complete secondary front wall (*lamina peristomica* of Jullien)†; such forms are *Steginomorphs*, and occur independently in several genera.

This general evolutionary history is corroborated in individual cases by the facts of development. Ontogeny is often used to elucidate the course of phylogeny, and the ontogenetic stages of individual œcia can sometimes be seen at the growing edge of the colony. But commoner and far more useful are the growth-stages of the colony itself. Astogeny‡, like ontogeny, is frequently a useful guide to the phylogeny of the form considered, and in fossil Polyzoa

* See Lang, 1916, Geol. Mag. dec. vi. vol. iii. pp. 74-77.

† Jullien, 1886, Bull. Soc. Zool. France, vol. xi. p. 609.

‡ Cumings, 1904, American Journ. Sci. vol. xvii. p. 50.

has this advantage, that each successive stage is left behind and not, as a rule, covered over or obscured by further growth.

A. Pelmatoporidæ, fam. nov.

Diagnosis. Multiserial Cheilostome Polyzoa of moderate or large size ($\frac{1}{2}$ mm. to $1\frac{3}{4}$ mm.), whose intraterminal front wall is typically built of hollow terminal spines bent over archwise, fused in the middle line, then bent vertically and continued as free spines, the broken ends of which form two rows of *pelmata* (if small, *pelmatidia*)—hobnail-like markings on the intraterminal front wall; lateral costal fusions and secondary pelmata or pelmatidia may be developed; apertural spines typically 4, but occasionally 5, 6, or 7; a secondary aperture generally attained, and by a variety of methods in the different lineages; avicularia primarily small and abundant (seldom absent), but may become, secondarily, of a considerable size.

Tabular Diagnoses of Subfamilies of Pelmatoporidæ.

- | | |
|--|---------------------------------|
| A. Costæ thin, with a single series of pelmatidia and no lateral costal fusions. | |
| I. Costæ separated by wide gaps | a. <i>Francoporinæ</i> . |
| II. Costæ touching or very close together. | |
| a. Avicularia occasional, rather large, and pointing obliquely proximally | b. <i>Opisthornithoporinæ</i> . |
| b. Avicularia generally abundant and not generally proximally directed. | |
| 1. Each half of the apertural bar bifid. | c. <i>Kelestominæ</i> . |
| 2. Apertural bar not bifid. | |
| a. Avicularia, if emerging from secondary tissue, are either several, placed around the aperture, or a pair laterally or proximally placed with regard to the aperture | d. <i>Tricephaloporinæ</i> . |
| β. A pair of avicularia, distally placed with regard to the aperture, emerge from secondary tissue which envelops the whole œcium otherwise, except the aperture and a small part of the intraterminal front wall; proximal apertural spines fuse with a median process of the apertural bar and with the distal apertural spines, forming a pair of hoop-like arches on each side of the aperture | |
| e. <i>Pnictoporinæ</i> . | |
| B. Costæ thin, with secondary pelmatidia and lateral costal fusions | f. <i>Castanoporinæ</i> . |

- C. Costæ stout, with a lateral row of pelmata
and a median row of pelmatidia g. *Diacanthoporinæ*.
D. Costæ stout, with one or more series of
pelmata h. *Pelmatoporinæ*.

a. *FRANCOPORINÆ*, subfam. nov.

Tabular Diagnoses of Genera and Species.

- A. Pelmatidia sometimes visible; intraterminal
front wall arched and not sunk in secondary
tissue I. *Francopora*.
B. Pelmatidia quite obliterated by secondary
tissue in the median area of fusion; cœcia
tend to be immersed in secondary interœcial
tissue II. *Baptopora*.
a. Smaller, about $\frac{2}{3}$ mm.; secondary aperture
proximally formed by a process of the
apertural bar which probably fuses with
the proximal pair of apertural spines to
form hoop-like structures 1. *B. immersa*.
b. Larger, more than $\frac{2}{3}$ mm.; secondary aperture
proximally complete, probably formed as
in (a), but with the "hoops" infilled with
secondary tissue 2. *B. insignis*.

I. *FRANCOPORA*, gen. nov.

Species. *Francopora canui*; Senonian [Coniacian]; Fé-
camp, N.E. of Le Havre, France.

Type-specimen. In the collection of F. Canu [a photograph
of type-specimen in the British Museum].

II. *BAPTOPORA*, gen. nov.

Genotype. *B. immersa*.

1. *B. immersa*, sp. n.

Type-specimen. British Museum, D. 28419; Coniacian;
Tours, France.

2. *B. [Escharipora] insignis* (d'Orbigny), Pal. Franç. 1851,
pl. 687. figs. 1-3, 1852, p. 231; Senonian [Santonian];
France.

b. *OPISTHORNITHOPORINÆ*.

OPISTHORNITHOPORA, gen. nov.

Species. *O. [Reptescharella] flabellata* (d'Orbigny), Pal.
Franç. 1852, pl. 716. figs. 9-12, 1853, p. 469; Senonian;
France. Interpreted according to M. Canu's identification
of a specimen in his collection.

c. *KELESTOMINÆ*, subfam. nov.

Tabular Diagnoses of Genera and Species.

- A. Costæ fairly widely separate; proximal pair of apertural spines not greatly enlarged I. *Kelestoma*.
 1. Asty incrusting 1. *K. elongatum*.
 2. Asty erect, cylindrical 2. *K. scalaris*.
- B. Costæ nearly touching; proximal pair of apertural spines enormously enlarged II. *Morphasmopora*.
 1. Avicularia, although involved in the proximal shield, are not raised on to it . 1. *M. jukes-brownei*.
 2. Avicularia raised high on the proximal shield 2. *M. brydonei*.

It is possible that *Membraniporella awrita*, Hennig, 1892, Stud. Bry. Sver. Krit.; Act. Univ. Lundensis, Lunds Univ. Års-skrift, vol. xxviii. p. 38, pl. ii. figs. 34-35; *mucronatus*-zone; Sweden; is a *Morphasmopora*.

I. *KELESTOMA*, Marsson.

Genotype. *K. elongatum*.

1. *K. elongatum*, Marsson, 1887, Pal. Abh. vol. iv. Heft 1, p. 99, pl. x. 13; *mucronatus*-zone; Rügen.

2. *K. scalaris*, sp. n.

Type-specimen. British Museum, D. 18006; *mucronatus*-zone; Rügen.

II. *MORPHASMOPORA*, gen. nov.

Genotype. *M. jukes-brownei* (Brydone).

1. *M. [Cribrilina] jukes-brownei* (Brydone), 1906, Geol. Mag. dec. v. vol. iii. p. 297, text-fig. 9 on p. 298; *mucronatus*-zone; Trimmingham, Norfolk.

2. *M. brydonei*, sp. n.

Type-specimen. British Museum, D. 15122; *mucronatus*-zone; Rügen.

d. *TRICEPHALOPORINÆ*, subfam. nov.

Tabular Diagnoses of Genera.

- A. Secondary aperture, if present, built up in connection with two avicularia at the proximo-lateral corners of, or laterally

with regard to, the aperture. [In *Haplocephalopora* these avicularia are not conspicuous on the greatly prolonged apertural ring.]

1. No secondary front wall is formed, or, if so, it is formed by the swamping of the intraterminal front wall by secondary tissue.
 - a. Paired avicularia, if on the apertural ring, stand out laterally on each side of the aperture I. *Tricephalopora*.
 - b. Paired avicularia tend to disappear in the greatly prolonged apertural ring . II. *Haplocephalopora*.
2. A secondary front wall tends to be formed by the secondary tissue around the aperture spreading proximally and laterally III. *Phractopora*.
- B. Secondary aperture always present and built up in connection with three, four, or more avicularia around the aperture.
 1. Cæcia of small size, about $\frac{2}{3}$ mm. long; less secondary tissue IV. *Polycephalopora*.
 2. Cæcia large, about 1 mm. long; more secondary tissue V. *Autropora*.

I. TRICEPHALOPORA, gen. nov.

Genotype. *T. triceps* (Marsson).

Tabular Diagnoses of the Species.

- A. Paired avicularia not carried up on to the apertural ring so as finally to fuse over the apertural bar; in some cases they are directed proximally.
- I. Apertural ring incomplete laterally.
 - a. Smaller, $\frac{1}{3}$ – $\frac{1}{2}$ mm. long; more secondary tissue 1. *T. prænuncia*.
 - b. Larger, $\frac{1}{2}$ – $\frac{2}{3}$ mm. long; less secondary tissue.
 1. Avicularia somewhat irregular, some proximally directed and some proximally placed with regard to the aperture 2. *T. ansata*.
 2. Avicularia regular and laterally placed with regard to the aperture 3. *T. vermicularis*.
- II. Apertural ring complete.
 - a. Avicularia blunt and round.
 1. Avicularia regular and all distally directed.
 - α . Median area of costal fusion smaller . 4. *T. capitata*.
 - β . Median area of costal fusion larger.
 - a. Cæcia hardly longer than broad .. 5. *T. brevis*.
 - b. Cæcia nearly twice as long as broad 6. *T. galeata*.
 2. Avicularia rather irregular and some proximally directed 7. *T. somptingensis*.

- b. Avicularia pointed and all proximally directed.
 - 1. Avicularia larger 8. *T. saltdeanensis*.
 - 2. Avicularia smaller 9. *T. pustulosa*.
- B. Paired avicularia carried up on to apertural ring and, finally, fuse over the apertural bar; always directed distally.
 - I. Secondary tissue, with regard to the intra-terminal front wall, is developed mainly over the median area of fusion.
 - a. Little or no intercecial secondary tissue .. 10. *T. languessensis*.
 - b. Abundant intercecial secondary tissue.
 - 1. Costæ coarser.
 - a. Larger, about $\frac{3}{4}$ mm. long 11. *T. trifaux*.
 - β. Smaller, less than $\frac{3}{4}$ mm. long.
 - a. Costæ about 12 12. *T. crepidula*.
 - b. Costæ about 16 13. *T. castrum*.
 - 2. Costæ finer.
 - a. Avicularia smaller 14. *T. triceps*.
 - β. Avicularia larger 15. *T. sherborni*.
 - II. Secondary tissue, with regard to the intra-terminal front wall, is developed mainly over its peripheral portions.
 - a. A fair amount of primary front wall still showing 16. *T. pinguis*.
 - b. Very little primary front wall still visible.
 - 1. Secondary aperture bent up at a high angle so as to be nearly vertical 17. *T. cerberus*.
 - 2. Secondary aperture bent up at a smaller angle 18. *T. prolifera*.

1. *T. prænuncia*, sp. n.

Type-specimen. In M. Canu's collection (a photograph of type-specimen in British Museum); Coniacian; Fécamp, N.E. of Le Havre, France.

2. *T. ansata*, sp. n.

Type-specimen. British Museum, D. 28168; Coniacian; Fécamp, N.E. of Le Havre, France.

- 3. *T. [Cellepora] vermicularis* (Geinitz), 1846, Grund. d. Verstein. p. 613, pl. xxiii. b, p. 35; *mucronatus*-zone; Rügen.
- 4. *T. [Membraniporella] capitata* (Canu), 1911, Ann. Mus. Nac. Buenos Aires, vol. xxi. (series 3, vol. xiv.), p. 251, pl. vi. figs. 1-3; Rocanéan; Rio Negro.
- 5. *T. [Semiescharipora] brevis* (d'Orbigny), Pal. Franç. 1852, pl. 718. figs. 21-24, 1853, p. 485; Senonian; Sainte Colombe, France.

6. *T. [Cellepora] galeata* (Geinitz), 1846, Grund. d. Verstein. p. 613, pl. xxiii. b, p. 34; *mucronatus*-zone; Rügen.

7. *T. somptingensis*, sp. n.

Type-specimen. British Museum, D. 28113; *quadratus*-zone; Sompting, N.E. of Worthing, Sussex.

8. *T. saltdeanensis*, sp. n.

Type-specimen. British Museum, D. 28915; *quadratus*-zone, *depressus*-subzone; E. of Brighton, Sussex.

9. *T. [Membraniporella] pustulosa* (Brydone), 1910, Geol. Mag. dec. v. vol. vii. p. 483, pl. xxxvi. fig. 9; *coranguinum*-zone (the figured specimen comes from Gravesend); Gravesend.

10. *T. languessensis*, sp. n.

Type-specimen. In collection of M. Canu (a photograph of type-specimen in British Museum); Campanian; Languesse, France.

11. *T. trifaux*, sp. n.

Type-specimen. British Museum, D. 15417; *mucronatus*-zone; Rügen.

12. *T. [Cellepora] crepidula* (von Hagenow), 1839, Neues Jahrbuch, p. 275, pl. iv. fig. 10 (interpreted, however, by Marsson, 1887, Pal. Abh. vol. iv. Heft 1, p. 97, pl. x. fig. 9); *mucronatus*-zone; Rügen.

13. *T. [Membraniporella] castrum* (Brydone), 1909, Geol. Mag. dec. v. vol. vi. p. 398, pl. xxii. figs. 4, 5; *mucronatus*-zone; Trimmingham.

14. *T. [Cribrilina] triceps* (Marsson), 1887, Pal. Abh. vol. iv. Heft 1, p. 98, pl. x. fig. 12; *mucronatus*-zone; Rügen.

15. *T. [Cribrilina] sherborni* (Brydone), 1906, Geol. Mag. dec. v. vol. iii. p. 296, text-fig. 7 on p. 296; *mucronatus*-zone; Trimmingham.

16. *T. [Cellepora, Escharoïdes] pinguis* (von Hagenow), 1851, Bry. Maastr. Kreid. p. 88, pl. x. fig. 15; Maastrichter-Kalk; Maastricht.

17. *T. cerberus*, sp. n.

Type-specimen. British Museum, D. 28205 ; Danian ; Faxe, Denmark.

18. *T. [Reptescharellina] prolifera* (Gabb & Horn), 1862, Journ. Ac. Nat. Sci. Philadelphia, series ii. vol. v. part ii. p. 146, pl. xx. fig. 28 ; Danian ; New Jersey.

II. HAPLOCEPHALOPORA, gen. nov.

Species. *H. uniceps*, sp. n.

Type-specimen. British Museum, D. 28214 ; Danian ; Faxe.

III. PHRACTOPORA, gen. nov.

Genotype. *P. constrata*.

Tabular Diagnoses of the Species.

- A. A V-shaped mass of secondary tissue grows proximally to the median process of the apertural bar and forms a secondary front wall ; incrusting forms.
- | | |
|-------------------------------|--------------------------|
| 1. V-shaped mass broad | 1. <i>P. operta</i> . |
| 2. V-shaped mass narrow | 2. <i>P. constrata</i> . |
- B. Secondary tissue above the V-shaped mass grows proximally to form a secondary front wall.
- | | |
|--|---------------------------|
| 1. Secondary front wall incomplete. | |
| a. Incrusting | 3. <i>P. obducta</i> . |
| β. Erect, unlaminar | 4. <i>P. obtecta</i> . |
| 2. Secondary front wall complete ; erect cylindrical | 5. <i>P. gastropora</i> . |

1. *P. operta*, sp. n.

Type-specimen. British Museum, D. 17997 ; *mucronatus*-zone ; Rügen.

2. *P. constrata*, sp. n.

Type-specimen. British Museum, D. 15332 ; *mucronatus*-zone ; Rügen.

3. *P. obducta*, sp. n.

Type-specimen. British Museum, D. 15395 ; *mucronatus*-zone ; Rügen.

4. *P. obtecta*, sp. n.

Type-specimen. British Museum, D. 15019, *mucronatus*-zone ; Rügen.

5. *P. [Porina] gastropora* (Marsson), 1887, Pal. Abh. vol. iv. Heft 1, p. 86, pl. viii. fig. 11 ; *mucronatus*-zone ; Rügen.

IV. POLYCEPHALOPORA, gen. nov.

Genotype. *P. hydra*.

Tabular Diagnoses of the Species.

- | | |
|---|---------------------------|
| A. Apertures generally surrounded by three avicularia only, two proximal-lateral and one distal-lateral | 1. <i>P. trigemina</i> . |
| B. Apertures generally surrounded with four avicularia. | |
| I. Incrusting, unilaminar ; æcia shorter, about once-and-a-half as long as broad. | |
| a. Less secondary interœcial tissue | 2. <i>P. rustica</i> . |
| b. More secondary interœcial tissue | 3. <i>P. hydra</i> . |
| II. Incrusting, unilaminar ; æcia longer, about twice as long as broad | 4. <i>P. plicatella</i> . |
| III. Incrusting, multilaminar ; æcia about once-and-a-half as long as broad. | |
| a. Costæ less than 20 | 5. <i>P. multiplex</i> . |
| b. Costæ more than 20 | 6. <i>P. insignis</i> . |
| C. Apertures generally surrounded with five avicularia. | |
| I. Incrusting or erect, unilaminar. | |
| a. Less coarse, $\frac{2}{3}$ mm. long, or less ; apertural bar very swollen | 7. <i>P. turgida</i> . |
| b. Coarser. | |
| 1. A fair amount of secondary interœcial tissue | 8. <i>P. multiceps</i> . |
| 2. Little or no secondary interœcial tissue. | 9. <i>P. bulbifera</i> . |
| II. Erect, bilaminar | 10. <i>P. pentapora</i> . |

Membraniporella obscurata, Brydone (1916, Geol. Mag. dec. vi. vol. iii. p. 99, pl. vi. figs. 9, 10), from the *cortestudinarium*-zone of S. England is possibly a *Polycephalopora*, but the figure and description are not clear enough to certify this.

1. *P. trigemina*, sp. n.

Type-specimen. British Museum, D. 29003 ; *quadratus*-zone ; *depressus*-subzone ; E. of Brighton, Sussex.

2. *P. [Semiescharipora] rustica* (d'Orbigny), Pal. Franç. 1852, pl. 718. figs. 13-16, 1853, p. 484 ; Senonian ; Sainte-Colombe, France.

3. *P. hydra*, sp. n.

Type-specimen. British Museum, D. 18001 ; *mucronatus*-zone ; Rügen.

4. *P. [Cellepora, Escharina] plicatella* (von Hagenow), 1851, Bry. Maestr. Kreid. p. 89, pl. x. fig. 12; Maastrichter-Kalk; Maastricht.

5. *P. multiplex*, sp. n.

Type-specimen. British Museum, D. 28944; *quadratus*-zone, *depressus*-subzone; N.E. of Worthing, Sussex.

6. *P. [Multescharipora] insignis* (d'Orbigny), Pal. Franç. 1852, pl. 720. figs. 11-15, 1853, p. 496; Senonian, [Campanian]; Meudon, France.

7. *P. turgida*, sp. n.

Type-specimen. British Museum, D. 29000; *quadratus*-zone, *pillula*-subzone; E. of Brighton, Sussex.

8. *P. multiceps*, sp. n.

Type-specimen. British Museum, D. 15370; *mucronatus*-zone; Rügen.

9. *P. [Escharina] bulbifera* (Römer), 1840, Verstein. nord-deutsch. kreid. p. 14, pl. v. fig. 6; Ober kreidemergel [Campanian]; Gehrden, Hanover.

10. *P. [Escharipora] pentapora* (D'Orbigny), Pal. Franç. 1851, pl. 685. figs. 5-8, 1852, p. 224; Senonian; Sainte-Colombe, France.

V. ANTROPORA, gen. nov.

Genotype. *A. cavernosa*.

Tabular Diagnoses of the Species.

A. A secondary front wall aimed at, though not attained.

1. Incrusting, typically with five avicularia . . . 1. *A. specus*.

2. Erect, unilaminar, typically with four avicularia, though often more 2. *A. spelunca*.

B. A complete secondary front wall attained.

1. Generally two longitudinal slits left above the intraterminal front wall, which may, however, be united proximally; apertures very large, about $\frac{1}{2}$ mm. in diameter 3. *A. cavernosa*.

2. A semilunar slit left immediately proximally to the apertures; apertures not nearly $\frac{1}{2}$ mm. in diameter 4. *A. lunaris*.

1. *A. specus*, sp. n.

Type-specimen. British Museum, D. 15362; *mucronatus*-zone; Rügen.

2. *A. spelunca*, sp. n.

Type-specimen. British Museum, D. 14972; *mucronatus*-zone; Rügen.

3. *A. cavernosa*, sp. n.

Type-specimen. British Museum, D. 15438; *mucronatus*-zone; Rügen.

4. *A. lunaris*, sp. n.

Type-specimen. In the collection of M. Canu (a photograph of type-specimen in British Museum); Campanian; Meudon.

e. *PNICTOPORINÆ*, subfam. nov.*PNICTOPORA*, gen. nov.

Genotype. *P. suffocata*.

Tabular Diagnoses of the Species.

- | | |
|---|----------------------------|
| A. Secondary tissue like bark, but not very rugose. | |
| 1. Secondary tissue well developed, but not enough to swamp the avicularia to a great extent. | |
| a. Incrusting | 1. <i>P. alligata</i> . |
| b. Erect, cylindrical | 2. <i>P. suffocata</i> . |
| 2. Secondary tissue more developed, so that even the avicularia tend to be swamped.. | 3. <i>P. strangulata</i> . |
| B. Secondary tissue very rugose | 4. <i>P. obstructa</i> . |

1. *P. alligata*, sp. n.

Type-specimen. British Museum, D. 8283; *coranguinum*-zone; Gillingham, Kent.

2. *P. suffocata*, sp. n.

Type-specimen. British Museum, D. 28525; *cortestudinarium*-zone; Luton, Kent.

3. *P. strangulata*, sp. n.

Type-specimen. British Museum, D. 21180; *coranguinum*-zone; Span Hill, Oxon.

4. *P. obstructa*, sp. n.

Type-specimen. British Museum, D. 21183; *coranguinum*-zone; Wooburn Green, Bucks.

f. *CASTANOPORINÆ*, subfam. nov.

Tabular Diagnoses of the Genera.

- A. No secondary front wall formed.
 - I. Ring of secondary aperture incomplete.
 - a. Proximal shield, if present, formed by the flattening of the apertural bar.
 - 1. Smaller.
 - a. No avicularia I. *Anornithopora*.
 - β. Avicularia pointing in various directions II. *Carydiopora*.
 - 2. Larger, avicularia of two kinds, (1) directed distally and (2) directed proximally (the latter kind may be very rare or absent) III. *Castanopora*.
 - 3. Larger, avicularia (if present) of one kind only, proximally directed IV. *Rhiniopora*.
 - b. Proximal shield formed by the ends of the apertural bar produced upwards, fusing and making a hoop over the apertural bar V. *Phrynopora*.
 - II. Ring of secondary aperture complete.
 - a. Costæ finer, apertural ring solid VI. *Hesperopora*.
 - b. Costæ coarser, apertural ring with large perforations VII. *Stichocados*.
- B. A secondary front wall (lamina peristomica of Jullien).
 - I. Secondary front wall formed by the expansion of branched apertural spines and ? of apertural avicularia VIII. *Ubaghsia*.
 - II. Secondary front wall formed by the expansions of a pair of apertural avicularia.
 - a. Erect, unilaminar IX. *Steginopora*.
 - b. Erect, bilaminar X. *Disteginopora*.

I. ANORNITHOPORA, gen. nov.

Genotype. *A. involucris*.

Tabular Diagnoses of the Species.

- A. Costæ about 17; intraterminal front wall less consolidated; apertural spines 4 1. *A. involucris*.
- B. Costæ about 10-12; intraterminal front wall more consolidated; apertural spines 5 or 6 2. *A. irrostrata*.

1. *A. involucris*, sp. n.

Type-specimen. British Museum, D. 28111; *quadratus*-zone, [*quadratus*-subzone]; N.E. of Worthing, Sussex.

2. *A. irrostrata*, sp. n.

Type-specimen. British Museum, D. 28994; *quadratus*-zone, *pillula*-subzone; N.E. of Worthing, Sussex.

II. CARYDIOPORA, gen. nov.

Genotype. *C. nucula*.

Tabular Diagnoses of Species.

- | | |
|--|------------------------|
| A. Avicularia fewer, smaller, and less pointed;
less interœcial secondary tissue. | |
| 1. More costæ, about 20 | 1. <i>C. nucella</i> . |
| 2. Fewer costæ, about 14 | 2. <i>C. coryli</i> . |
| B. Avicularia more, larger and more pointed;
more interœcial secondary tissue; costæ
12-14 | |
| | 3. <i>C. nucula</i> . |

1. *C. nucella*, sp. n.

Type-specimen. British Museum, D. 28995; *quadratus*-zone, *depressus*-subzone; E. of Brighton, Sussex.

2. *C. coryli*, sp. n.

Type-specimen. British Museum, D. 28998; *quadratus*-zone, *pillula*-subzone; North Lancing, Sussex.

3. *C. nucula*, sp. n.

Type-specimen. British Museum, D. 28993; *Marsupites*-zone; Brighton, Sussex.

III. CASTANOPORA, gen. nov.

Genotype. *C. castanea*.

Tabular Diagnoses of Species.

- | | |
|---|--------------------------|
| A. Large, proximally directed avicularia abundant. | 1. <i>C. retrorsa</i> . |
| B. Large, proximally directed avicularia absent or rare. | |
| I. Length not more than .75 mm. and œcia very stout | 2. <i>C. dibleyi</i> . |
| II. Length about 1 mm.; œcia longer rather than broad. | |
| a. Costæ more than 25. | |
| 1. Avicularia more proximally placed with regard to the aperture; incrusting | 3. <i>C. ornata</i> . |
| 2. Avicularia distally and laterally placed with regard to the aperture; erect, bilaminar | 4. <i>C. magnifica</i> . |

6. Costæ 20-25.

1. Costæ 20-22, 5-6 lateral costal fusions.

α. Apertures supra-semicircular; apertural spines not much thickened, apertural bar flattened, not very high 5. *C. nucifera*.

β. Apertures somewhat cribriline; apertural spines considerably thickened, apertural bar stouter than α 6. *C. juglans*.

2. Costæ 20-25, 6-7 lateral costal fusions.

α. Apertures hardly cribriline, length about .9 mm.; proximally directed avicularia ? occasional 7. *C. castanea*.

β. Apertures cribriline, length at least 1 mm.; proximally directed avicularia rare or absent.

a. Length 1-1½ mm.; aperture slightly cribriline 8. *C. glandulosa*.

b. Length 2 mm.; aperture markedly cribriline 9. *C. guascoi*.

1. *C. retrorsa*, sp. n.

Type-specimen. British Museum, D. 21170; *Marsupites*-zone; Odiham, Hants.

2. *C. [Cribrilina] dibleyi* (Brydone), 1906, *Geol. Mag.* dec. v. vol. iii. p. 297, text-fig. 8 on p. 297; *mucronatus*-zone; Trimingham, Norfolk.

3. *C. [Reptescharipora] ornata* (d'Orbigny), *Pal. Franç.* 1852, pl. 720. figs. 6-8, 1853, p. 494; Senonian; Vendôme, France.

4. *C. [Escharipora] magnifica* (d'Orbigny), *Pal. Franç.* 1851, pl. 686. figs. 1-5; *Escharipora pretiosa*, d'Orbigny, 1852, *Pal. Franç.* p. 227; Senonian [Campanian]; Sainte Colombe and Royan, France.

5. *C. nucifera*, sp. n.

Type-specimen. British Museum, D. 15600; *mucronatus*-zone; Trimingham, Norfolk.

6. *C. juglans*, sp. n.

Type-specimen. British Museum, D. 15608; *mucronatus*-zone; Trimingham, Norfolk.

7. *C. castanea*, sp. n.

Type-specimen. British Museum, D. 16654; *mucronatus*-zone; Rügen.

8. *C. glandulosa*, sp. n.

Type-specimen. British Museum, D. 15009; *mucronatus*-zone; Rügen.

9. *C. [Escharipora] guascoi* (Ubaghs); 1865, Verh. nat. Verein. pruss. Rheinlande und Westphalens, vol. xxii. p. 51, pl. ii. fig. 3; Maastrichtian; Valkenburg, near Maastricht.

IV. RHINIOPORA, gen. nov.

Tabular Diagnoses of the Species.

- A. Avicularia numerous.
- I. Costæ more than 30 1. *R. labiata*.
 - II. Costæ generally less than 30 2. *R. aviculosa*.
- B. Avicularia rare or absent.
- I. Length about 1 mm.; costæ about 16 to 20; 5 or 6 lateral costal fusions.
 - a. Incrusting.
 1. Costæ fewer, 16-18; aperture sub-semicircular 3. *R. radiata*.
 2. Costæ more, 18-20; aperture supra-semicircular 4. *R. aspera*.
 - b. Erect, unilaminar 5. *R. asperula*.
 - c. Erect, cylindrical 6. *R. hispida*.
 - II. Length 1.5-1.7 mm.
 - a. Costæ 20-23; apertural spines 4; 6-7 lateral costal fusions; length 1.5 mm. Aperture semicircular or supra-semicircular.
 1. Incrusting 7. *R. cacus*.
 2. Erect, unilaminar 8. *R. horrida*.
 - b. Costæ about 26; apertural spines 6-7; about 7 lateral costal fusions; length 1.6-1.7 mm.; aperture slightly cribriline 9. *R. scabra*.
 - c. Costæ about 28-30; apertural spines 6-7; about 7 lateral costal fusions; length 1.5-1.7 mm.; aperture markedly cribriline .. 10. *R. jurassica*.

It is probable that *Cellepora perforata*, Quenstedt, 1879, Pet. Deutsch. Abt. i. Band. vi. Heft 2, p. 312, pl. cliv. fig. 37, Maastricht, is a *Rhiniopora*, but the characters cannot be determined in sufficient detail to place it.

1. *R. [Cribrilina] labiata* (Levinson), 1907, Over. ov. d. Kgl. Danske Vidensk. Selsk. Forhand. for 1907, No. 4, pp. 155-6, 158, Plate opposite p. 160, fig. 1; [Cretaceous].

2. *R. aviculosa*, sp. n.

Type-specimen. In collection of M. Canu (photograph

of type-specimen in British Museum); Maastrichtian; Maastricht.

3. *R. [Reptescharella] radiata* (d'Orbigny), Pal. Franç. 1852, pl. 716. figs. 4-6, 1853, p. 468. *Reptescharella subradiata*, d'Orbigny, 1854, Pal. Franç. p. 1106; Senonian [Campanian]; Meudon and Saintes, France.

4. *R. aspera*, sp. n.

Type-specimen. British Museum, D. 15620; *mucronatus*-zone; Trimingham, Norfolk.

5. *R. [Cribrilina] asperula* (Marsson), 1887, Pal. Abh. vol. iv. Heft 1, p. 97, pl. x. fig. 8; *mucronatus*-zone; Rügen.

6. *R. hispida*, sp. n.

Type-specimen. British Museum, D. 14996; *mucronatus*-zone; Rügen.

7. *R. [Cribrilina] cacus* (Brydone), 1913, Geol. Mag. dec. v. vol. x. p. 437, pl. xiv. figs. 6-8; *mucronatus*-zone; Trimingham, Norfolk.

8. *R. horrida*, sp. n.

Type-specimen. British Museum, D. 14171; *mucronatus*-zone; Rügen.

9. *R. scabra*, sp. n.

Type-specimen. British Museum, D. 14207; *mucronatus*-zone; Rügen.

10. *R. [Membranipora] jurassica* (Gregory), 1894, Geol. Mag. dec. iv. vol. i. p. 62, text-fig. 1; Bathonian; Ranville. [Maastrichtian; Maastricht]. *Type-specimen*. British Museum, D. 180.

V. PHRYNOPORA, gen. nov.

Genotype. *P. bufo*.

Tabular Diagnoses of the Species.

- | | |
|---|-------------------------|
| A. Apertural hoop narrow and slight | 1. <i>P. bufo</i> . |
| B. Apertural hoop enormously swollen and enlarged | 2. <i>P. arcifera</i> . |
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1. *P. bufo*, sp. n.

Type-specimen. British Museum, D. 14974; *mucronatus*-zone; Rügen.

2. *P. [Ubaghsia] arcifera* (Jullien), 1886, Bull. Soc. Zool. France, vol. xi. p. 618, pl. xx. figs. 2-4; Campanian; Meudon.

VI. *HESPEROPORA*, gen. nov.

Genotype. *H. occidentalis*.

Tabular Diagnoses of the Species.

- A. *Œcia* nearly as broad as long; secondary aperture not so well-formed and subcircular.
 I. Costæ about 12; an occasional avicularium .. 1. ? *H. walfordi*.
 II. Costæ about 16..... 2. *H. occidentalis*.
 B. *Œcia* nearly twice as long as broad; secondary aperture more tubular and subtriangular; costæ about 16 3. *H. danica*.
 1. ? *H. [Cribrilina] walfordi* (Pergens), 1894, Bull. Soc. Belg. Géol. Pal. Hyd. vol. vii. Mémoires, p. 187, pl. xi. fig. 6; Maastrichtian; Fauquemont.

2. *H. occidentalis*, sp. n.

Type-specimen. British Museum, D. 19233; Danian; New Jersey.

3. *H. danica*, sp. n.

Type-specimen. British Museum, D. 28304; Danian; Faxe, Denmark.

VII. *STICHOCADOS*, Marsson.

Genotype. *S. verruculosus*.

Tabular Diagnoses of the Species.

- A. Costæ 12-14, with 4-5 lateral fusions; length about .8 mm. 1. *S. möenensis*.
 B. Costæ about 12, with 3 lateral fusions; length .6-.7 mm. 2. *S. ordinatus*.
 C. Costæ about 9, with 3-4 lateral fusions; length about .5 mm. 3. *S. compositus*.
 D. Costæ 6-7, with 2 lateral fusions; length about .6 mm. 4. *S. verruculosus*.

1. *S. möenensis*, sp. n.

Type-specimen. In collection of M. Canu (a photograph of type-specimen in British Museum); Danian; Möen.

2. *S. ordinatus*, sp. n.

Type-specimen. British Museum, D. 15115; *mucronatus*-zone; Rügen.

3. *S. compositus*, sp. n.

Type-specimen. British Museum, D. 18977; Danian; New Jersey, U.S.A.

4. *S. verruculosus*, Marsson, 1887, Pal. Abh. Band iv. Heft 1, p. 101, pl. x. fig. 15; *mucronatus*-zone; Rügen.

VIII. UBAGHSIA, Jullien.

Genotype. *U. reticulata*.

Tabular Diagnoses of the Species.

A. Apertural spines with few branches.

I. Apertures, avicularia and other spaces in the secondary front wall form a regular pattern; a shallow groove proximally placed with regard to the aperture in the secondary front wall 1. *U. ocellata*.

II. Apertures, avicularia, and other spaces in the secondary front wall very irregularly arranged; no shallow groove as in I. 2. *U. reticulata*.

B. Apertural spines with many branches.

I. Smaller; apertures, avicularia, and other spaces in the secondary front wall form a regular pattern; a shallow groove proximally placed with regard to the aperture in the secondary front wall 3. *U. demorgani*.

II. Larger; apertures, avicularia, and other spaces in the secondary front wall very irregularly arranged; no shallow groove as in I. 4. *U. meudonensis*.

1. *U. [Steginopora] ocellata* (J. Jullien), 1886, Bull. Soc. Zool. France. vol. xi. p. 614, pl. xix. figs. 1-3; Senonian [Campanian]; Port Brehay, France.

2. *U. [Steginopora] reticulata* (Ubaghs), 1865, Verh. nat. Verein. pruss. Rhein. Westphalens, vol. xxii. p. 55, pl. ii. a, fig. 7; Maastrichtian; Valkenberg and Geulem near Maastricht.

3. *U. [Steginopora] demorgani* (Jullien), 1886, Bull. Soc. Zool. France, vol. xi. p. 615, pl. xix. figs. 4-5, pl. xx. fig. 1; Senonian [Campanian]; near Meudon, France.
4. *U. [Steginopora] meudonensis* (Jullien), 1886, op. cit. p. 614, pl. xvii. & pl. xviii. figs. 1-3; Senonian [Campanian]; near Meudon, France.

IX. STEGINOPORA, d'Orbigny.

Genolectotype. *S. ornata*.

Tabular Diagnoses of the Species.

- A. Larger; paired avicularia do not project above secondary front wall 1. *S. ornata*.
 - B. Smaller; paired avicularia project above secondary front wall 2. *S. aculeata*.
1. *S. ornata*, d'Orbigny, Pal. Franç. 1852, pl. 721. figs. 1-4, 1853, p. 501; Senonian; Sainte-Colombe, France.
 2. *S. aculeata*, d'Orbigny, Pal. Franç. 1852, pl. 721. figs. 5-8, 1853, p. 502; Senonian; Sainte-Colombe, France.

- X. DISTEGINOPORA, d'Orbigny, 1852, Pal. Franç. p. 235 (= *Thoracophora*, J. Jullien, 1886, Bull. Soc. Zool. France, vol. xi. p. 610).

Genotype and only species here included. *D. [Eschara] horrida* (d'Orbigny), 1850, Prod. Pal. vol. ii. p. 264; Senonian [Campanian]; Meudon, France.

g. *DIACANTHOPORINÆ*, subfam. nov.

DIACANTHOPORA, gen. nov.

Genotype. *D. bispinosa*.

Tabular Diagnoses of the Species.

- A. Avicularia consisting of a pair distally placed with regard to each aperture and directed outwards 1. *D. bispinosa*.
- B. Avicularia consisting of a pair proximally placed with regard to each aperture and directed inwards.
 - I. Ecia fairly close together 2. *D. abbottii*.
 - II. Ecia widely spaced 3. *D. distans*.

1. *D. bispinosa*, sp. n.

Type-specimen. British Museum, D. 8986 ; Danian ; Faxø, Denmark.

2. *D. [Escharipora] abbottii* (Gabb & Horn), 1862, Journ. Acad. Nat. Sci. Philadelphia, 2nd series, vol. v. part ii. p. 149, pl. xx. fig. 33 ; Danian ; New Jersey, U.S.A.

3. *D. [Escharipora] distans* (Gabb & Horn), 1862, op. cit. p. 148, pl. xx. fig. 32 ; Danian ; New Jersey, U.S.A.

h. *PELMATOPORINÆ*, subfam. nov.

Tabular Diagnoses of the Genera.

- A. Secondary aperture, when present, formed of distal shield only.
 - I. Distal shield, when present, formed of a pair of avicularia.
 - a. Distal shield, when present, incomplete I. *Pelmatopora*.
 - b. Distal shield always present, complete and stout II. *Decurtaria*.
 - II. Distal shield always present, formed of apertural spines III. *Murinopsia*.
- B. Proximal shield of secondary aperture, in so far as it is present, formed of a median process of the apertural bar which ultimately fuses with the proximal pair of apertural spines IV. *Sandalopora*.
- C. Proximal shield of secondary aperture, in so far as it is present, formed by the upward growth of a pair of avicularia, placed laterally and proximally with regard to the aperture, fusing over the apertural bar, which thus does not take part in its formation.
 - I. One row of pelmata only (a doubtful second row is sometimes distinguishable) V. *Ichnopora*.
 - II. Two or more rows of pelmata.
 - a. Apertures remain wide ; tissue of secondary aperture spreads around, and finally forms a secondary front wall (lamina peristomica of Jullien) VI. *Batrachopora*.
 - b. Apertures become tubular and further growth of secondary tissue prolongs the tubular aperture VII. *Pachyderma*.

I. *PELMATOPORA*, gen. nov.

Genotype. *P. pero*.

Tabular Diagnoses of the Species.

- A. Avicularia do not replace distal apertural spines (*i. e.*, there is no distal shield).
- I. Median area of fusion is imperforate and there are no secondary pelmata.
 - a. Intraterminal front wall well arched.
 1. Little or no secondary interœcial tissue; avicularia small and blunt.
 - a. Avicularia sporadic 1. *P. calceata*.
 - β. Avicularia tend to be arranged 2 proximally and 2 distally with regard to the aperture 2. *P. crepidaria*.
 2. A fair amount of secondary interœcial tissue 3. *P. solearis*.
 - b. Intraterminal front wall flat.
 1. Erect, unilaminar 4. *P. interrupta*.
 2. Erect, bilaminar.
 - a. Costæ about 20 5. *P. chrysalis*.
 - β. Costæ 25 or more 6. *P. striata*.
 - II. Median area of fusion with two rows of perforations; secondary pelmata present.
 - a. A pair of avicularia placed regularly, proximally and laterally with regard to each aperture 7. *P. d'orbigny*.
 - b. Avicularia sporadic.
 1. Costæ 12–16; apertures large.
 - a. Intraterminal front wall distinctly arched.
 - a. Costæ 12 8. *P. pauciclavia*.
 - b. Costæ 15 9. *P. quadrata*.
 - β. Intraterminal front wall fairly flat 10. *P. fragilis*.
 2. Costæ more than 16, length nearly 1 mm.
 - a. Less secondary interœcial tissue 11. *P. insignis*.
 - β. More secondary interœcial tissue.
 - a. Apertures smaller, tending to be pointed 12. *P. suffulta*.
 - b. Apertures larger, tending to be rounded 13. *P. fecampensis*.
 3. Costæ more than 16, length not much over $\frac{1}{2}$ mm.
 - a. Apertures larger 14. *P. filiozati*.
 - β. Apertures smaller 15. *P. gasteri*.
 - III. Median area of fusion with more than two rows of perforations; secondary and tertiary pelmata.
 - a. Incrusting; length less than 1 mm.
 - a. Costæ 15 16. *P. plantaris*.
 - β. Costæ 18–20 17. *P. simplex*.
 - b. Erect, unilaminar; length more than 1 mm.; costæ 16–18 18. *P. pero*.
- B. Apertural spines are replaced by avicularia (*i. e.*, a distal shield more or less present).
- I. Both pairs of apertural spines are replaced by avicularia 19. *P. quadrivolucris*.
 - II. Distal pair only of apertural spines is replaced by avicularia.

- a. Proximal apertural spines are often still visible and sometimes the distal pair as well 20. *P. brydonei*.
- b. Proximal apertural spines (except in neanastic stages) entirely swamped by secondary tissue, also (except in neanastic stages) the distal pair, which are replaced by a pair of avicularia.
 1. Avicularia minute, though they may be somewhat lengthened 21. *P. bidens*.
 2. Avicularia stout, short, and peg-like; costæ 15-18.
 - a. Incrusting 22. *P. marsupitorium*.
 - β. Erect, unilaminar 23. *P. roedeanensis*.
 3. Avicularia long and hardly flattened.
 - a. Costæ about 15-20.
 1. Length about 1 mm.
 - a. Incrusting 24. *P. danktonensis*.
 - b. Unilaminar, erect 25. *P. tancingensis*.
 2. Length less than 1 mm.; outermost intercostal perforations less slot-like.
 - a. Incrusting.
 - α. Less secondary interœcial tissue .. 26. *P. saltdeanensis*.
 - β. More secondary interœcial tissue .. 27. *P. collium*.
 - b. Unilaminar, erect 28. *P. promontorium*.
 - β. Costæ about 12-15; outermost intercostal perforations circular; length considerably less than 1 mm.
 1. Incrusting 29. *P. ramunculoides*.
 2. Unilaminar, erect 30. *P. lacuum*.
 - γ. Costæ 10; otherwise as β; incrusting. 31. *P. gyrimoides*.
 4. Avicularia flattened and broad distally, and tend to bifurcate 32. *P. somptingensis*.
 5. Avicularia very broad distally and distinctly bilobed.
 - α. Incrusting 33. *P. gregoryi*.
 - β. Erect, unilaminar 34. *P. palmata*.
 - γ. Erect, bilaminar. 35. *P. damicornis*.

1. *P. calceata*, sp. n.

Type-specimen. British Museum, D. 4032; Lower Senonian; Chatham, Kent.

2. *P. crepidaria*, sp. n.

Type-specimen. British Museum, D. 21200; *coranguinum*-zone; Wooburn Green, Bucks.

3. *P. solearis*, sp. n.

Type-specimen. British Museum, D. 21211; *coranguinum*-zone; Hurley Bottom, Berks.

4. *P. [Semiescharipora] interrupta* (d'Orbigny). Pal. Franç. 1852, pl. 719. figs. 5-8, 1853, p. 487; Senonian;

Saintes, France. [Interpreted according to Canu's identification of a specimen from the Coniacian of Tours, in his collection, of which a photograph is in the British Museum.]

5. *P. [Escharipora] chrysalis* (d'Orbigny), Pal. Franç. 1851, pl. 686. figs. 6-8, 1852, p. 228; Senonian; Fief-neuf and Pons, France.
6. *P. [Escharipora] striata* (d'Orbigny), Pal. Franç. 1851, pl. 686. figs. 9-12, 1852, p. 229; [Senonian]; Sainte-Colombe. = *Escharipora mumia*, d'Orbigny, Pal. Franç. 1851, pl. 687. figs. 4-6, 1852, p. 233; [Senonian]; Sainte-Colombe, *fide* Canu, 1900, Bull. Soc. Geol. France, series iii. vol. xviii. p. 450. [Interpreted according to Canu's identification of a specimen from the Coniacian of Villedieu, in his collection, of which a photograph is in the British Museum.]

7. *P. d'orbignyi*, sp. n.

Type-specimen. British Museum, D. 28453; Coniacian; St. Avertin.

8. *P. pauciclavia*, sp. n.

Type-specimen. British Museum, D. 28273; base of *coranguinum*-zone; E. of Cuckmere Haven, Sussex.

9. *P. quadrata*, sp. n.

Type-specimen. British Museum, D. 28271; base of *coranguinum*-zone; E. of Cuckmere Haven, Sussex.

10. *P. [Semiescharipora] fragilis* (d'Orbigny), Pal. Franç. 1852, pl. 717. figs. 8-11, 1853, p. 480; Senonian [Coniacian]; Fécamp. [Interpreted according to Canu's identification of a specimen from the Emscherian of Fécamp, in his collection, of which there is a photograph in the British Museum.]
11. *P. [Cribrilina] insignis* (Canu), 1911, Ann. Mus. Nac. Buenos Aires, vol. xxi. (3rd series, vol. xiv.) p. 252, pl. vi. figs. 7-10; Rocanéan; Roca, Argentine, S. America.
12. *P. [Cribrilina] suffulta* (Brydone), 1913, Geol. Mag. dec. v. vol. x. p. 436, pl. xiv. fig. 4; *coranguinum*-zone; Gravesend, Kent.

13. *P. fecampensis*, sp. n.

Type-specimen. British Museum, D. 28473 ; Senonian, Coniacian ; Fécamp, France.

14. *P. fillozati*, sp. n.

Type-specimen. In collection of M. Canu (photograph of type-specimen in British Museum) ; Emscherian ; Fécamp, France.

15. *P. gasteri*, sp. n.

Type-specimen. British Museum, D. 28274 ; low in *coranguinum*-zone ; Cuckmere Haven, Sussex.

16. *P. plantaris*, sp. n.

Type-specimen. British Museum, D. 19620 ; *coranguinum*-zone ; Alton, Hants.

17. *P. simplex*, sp. n.

Type-specimen. British Museum, D. 28281 ; *quadratus*-zone ; Newhaven, Sussex.

18. *P. pero*, sp. n.

Type-specimen. British Museum, D. 23405 ; top of *coranguinum*-zone ; Epsom, Surrey.

19. *P. quadrivolucris*, sp. n.

Type-specimen. British Museum, D. 28907 ; *coranguinum*-zone ; West Horsley, Surrey.

20. *P. brydonei*, sp. n.

Type-specimen. British Museum, D. 23396 ; top of *coranguinum*-zone ; Epsom, Surrey.

21. *P. bidens*, sp. n.

Type-specimen. British Museum, D. 28934 ; *quadratus*-zone, *pillula*-subzone ; North Lancing, Sussex.

22. *P. marsupitorum*, sp. n.

Type-specimen. British Museum, D. 28867 ; *Marsupites*-zone ; Brighton, Sussex.

23. *P. roedeanensis*, sp. n.

Type-specimen. British Museum, D. 28868 ; *Marsupites*-zone ; Brighton, Sussex.

24. *P. danktonensis*, sp. n.

Type-specimen. British Museum, D. 23963; *quadratus*-zone, [*depressa*-subzone]; Sompting, Sussex.

25. *P. lancingsensis*, sp. n.

Type-specimen. British Museum, D. 28947; *quadratus*-zone, [*depressa*-subzone]; North Lancing, Sussex.

26. *P. saltdeanensis*, sp. n.

Type-specimen. British Museum, D. 28842; *quadratus*-zone, *depressa*-subzone; E. of Brighton, Sussex.

27. *P. collium*, sp. n.

Type-specimen. British Museum, D. 28824; *quadratus*-zone, [*pillula*-subzone]; North Lancing, Sussex.

28. *P. promontiorum*, sp. n.

Type-specimen. British Museum, D. 28930; *quadratus*-zone, [*pillula*-subzone]; North Lancing, Sussex.

29. *P. ranunculoides*, sp. n.

Type-specimen. British Museum, D. 28856; *quadratus*-zone, *depressa*-subzone; E. of Brighton, Sussex.

30. *P. lacuum*, sp. n.

Type-specimen. British Museum, D. 28862; *quadratus*-zone, [*pillula*-subzone]; North Lancing, Sussex.

31. *P. gyrinoides*, sp. n.

Type-specimen. British Museum, D. 28270; *quadratus*-zone; E. of Brighton, Sussex.

32. *P. somptingensis*, sp. n.

Type-specimen. British Museum, D. 28762; *quadratus*-zone, [*quadratus*-subzone]; Sompting, Sussex.

33. *P. [Cribrilina] gregoryi* (Brydone), 1906, Geol. Mag. dec. v. vol. iii. p. 300, text-fig. 13 on p. 300; and 1913, Geol. Mag. dec. v. vol. x. p. 436, pl. xiv. figs. 1, 2; *quadratus*-zone, *quadratus*-subzone; Upham, Hants.

34. *P. palmata*, sp. n.

Type-specimen. British Museum, D. 8010; *quadratus*-zone, *quadratus*-subzone; Winchester, Hants.

35. *P. damicornis*, sp. n.

Type-specimen. British Museum, D. 20204; *quadratus*-zone; Seaford, Sussex.

II. DECURTARIA, Jullien, 1886, Bull. Soc. Zool. France, vol. xi. p. 606.

Genotype and only species here recognized. *D.* [*Semiescharipora*] *cornuta* (Beissel), 1865, Nat. Ver. Hollandsche Maatsch. Wet. Haarlem, ser. 2, vol. xxii. Art. 3, p. 58, pl. vii. figs. 77-81; Maastrichtian; Aachen, Germany [= *Prosoporella*, Marsson, 1887, Pal. Abh. vol. iv. Heft 1, p. 100, with same genotype].

III. MURINOPSIA, Jullien, 1886, Bull. Soc. Zool. France, vol. xi. p. 608.

[= *Lagodiopsis*, Marsson, 1887, Pal. Abh. vol. iv. Heft 1, p. 99, genotype *Multescharipora francqana*, d'Orbigny.]
Genotype. *M. galeata*.

Tabular Diagnoses of the Species.

- A. A pair of tubular avicularia project distally to the distal shield 1. *M. francqana*.
 - B. More than one pair of tubular avicularia project distally to the distal shield 2. *M. galeata*.
1. *M.* [*Multescharipora*] *francqana* (d'Orbigny), Pal. Franç. 1852, pl. 734. figs. 6-8, 1853, p. 497; [Campanian]: Meudon, France.
 2. *M.* [*Semiescharipora*] *galeata* (Beissel), 1865, Nat. Ver. Hollandsche Maatsch. Wet. Haarlem, series 2, vol. xxii. Art. 3, p. 55, pl. vi. figs. 70-75, pl. vii. fig. 76; Maastrichtian; Aachen, Germany.

IV. SANDALOPORA, gen. nov.

Genotype. *S. soccata*.

Tabular Diagnoses of the Species.

- | | |
|--|------------------------------|
| A. Median process of the apertural bar flattened into a proximal shield. | |
| I. Incrusting | 1. <i>S. gallica</i> . |
| II. Erect, bilaminar | 2. <i>S. lavardinensis</i> . |
| B. Median process of the apertural bar spiniform. | |
| I. Little or no interœcial secondary tissue. | |
| a. Length about 1 mm.; costæ 18-20; erect, unilaminar | 3. <i>S. supposita</i> . |
| b. Length about $\frac{3}{4}$ mm.; costæ about 15; erect, unilaminar | 4. <i>S. soccata</i> . |
| c. Length about $\frac{1}{2}$ mm.; costæ about 12; incrusting | 5. <i>S. socculus</i> . |
| II. A fair amount of interœcial secondary tissue; erect, cylindrical | 6. <i>S. caligata</i> . |

1. *S. gallica*, sp. n.

Type-specimen. British Museum, D. 28422; Turonian; Lavardin, France.

2. *S. lavardinensis*, sp. n.

Type-specimen. British Museum, D. 28421; Turonian; Lavardin, France.

3. *S. supposita*, sp. n.

Type-specimen. British Museum, D. 28887; *cortestudinarium*-zone; Cuckmere Haven, Sussex.

4. *S. soccata*, sp. n.

Type-specimen. British Museum, D. 28257; *cortestudinarium*-zone; Cuckmere Haven, Sussex.

5. *S. socculus*, sp. n.

Type-specimen. British Museum, D. 24538; *coranguinum*-zone; Gillingham, Kent.

6. *S. caligata*, sp. n.

Type-specimen. British Museum, D. 2639; Lower Senonian; Chatham, Kent.

V. *ICHNOPORA*, gen. nov.

Genotype. *I. vestigium*.

Tabular Diagnoses of the Species.

A. Pelmata close to the middle line.

I. Costæ more than 20, length about 1 mm.

a. Erect, unilaminar.

1. Avicularia placed more proximally 1. ? *I. dentata*.

2. Avicularia placed more distally 2. *I. socia*.

b. Erect, bilaminar 3. *I. campestris*.

II. Costæ 15-20, length less than 1 mm.; erect, cylindrical

4. *I. filiformis*.

B. Pelmata close to the middle line in some oecia and somewhat separate in others, length less than 1 mm.; incrusting

5. *I. vestigium*.

C. Pelmata widely separate with occasional perforations in the median area of fusion, and secondary pelmata.

I. Costæ 15-20, length about 1 mm. 6. *I. amica*.

II. Costæ 10-15.

a. Avicularia do not fuse above the apertural bar.

1. Incrusting; avicularia very small and low 7. *I. cavia*.

2. Erect, unilaminar.

a. Avicularia small and low 8. *I. cunicula*.

β. Avicularia very large and fairly high . 9. *I. asella*.

3. Erect, bilaminar.

a. Avicularia rather small and low 10. ? *I. porigera*.

β. Avicularia large and very high 11. *I. leporina*.

b. Avicularia fuse above the apertural bar .. 12. *I. denticulata*.

1. ? *I. [Semiescharipora] dentata* (d'Orbigny), Pal. Franç. 1852, pl. 718. figs. 5-8, 1853, p. 482; Senonian; Meudon and Sainte-Colombe.

2. *I. socia*, sp. n.

Type-specimen. British Museum, D. 28479; Coniacian; Fécamp, France.

3. *I. campestris*, sp. n.

Type-specimen. British Museum, D. 28461; Coniacian; Fécamp, France.

4. *I. [Escharipora] filiformis* (d'Orbigny), 1852, Pal. Franç. p. 232, pl. 700. figs. 13-15; [Emscherian]; Fécamp, France. [Interpreted according to Canu's identifications of specimens from Fécamp in his collection, a photograph of one of which is in the British Museum.]

5. *I. vestigium*, sp. n.

Type-specimen. British Museum, D. 8133; *coranguinum*-zone; Gillingham, Kent.

6. *I. amica*, sp. n.

Type-specimen. In collection of M. Canu (a photograph of type-specimen in British Museum); Coniacian; Fécamp.

7. *I. cavia*, sp. n.

Type-specimen. British Museum, D. 28451; Coniacian; St. Avertin, France.

8. *I. cunicula*, sp. n.

Type-specimen. British Museum, D. 28437; Coniacian; La Ribochère, France.

9. *I. asella*, sp. n.

Type-specimen. British Museum, D. 28449; Coniacian; St. Avertin, France.

10. ? *I. [Eschara] porigera* (Stoliczka), 1872, "Cret. Fauna of Southern India, the Ciliopoda," Pal. Indica, ser. viii. vol. iv. no. ii. p. 15, pl. i. fig. 8; Arriallor group; Chokonadapooram.
11. *I. [Escharipora] leporina* (D'Orbigny), Pal. Franç. 1851, pl. 686. figs. 13-16, 1852, p. 230; Senonian; Villavard, France. [Interpreted according to Canu's identification of a specimen from the Emscherian of Fécamp, in his collection, of which there is a photograph in the British Museum.]
12. *I. [Steginopora] denticulata* (Brydone), 1910, Geol. Mag. dec. v. vol. vii. p. 481, pl. xxxvi. figs. 1-3; *coranguinum*-zone; Kent.

VI. BATRACHOPORA, gen. nov.

Genotype. *B. ranunculus*.

Tabular Diagnoses of the Species.

- A. Aperture smaller than the intraterminal front wall.
 - I. Paired avicularia remain small.
 - a. Apertures comparatively small and narrow.
 1. Œcia widely spaced 1. *B. perforata*.
 2. Œcia fairly close.
 - α. Erect, unilaminar 2. *B. ovalis*.
 - β. Erect, bilaminar 3. *B. royanensis*.
 - b. Apertures comparatively wide; costæ about 10 4. *B. crassa*.

- II. Paired avicularia large and (? always) meet over the apertural bar.
- a. Œcia smaller, 1 mm. or less 5. *B. ranunculus*.
 - b. Œcia larger, more than 1 mm.
 1. Œcia larger, twice as long as broad .. 6. *B. aurita*.
 2. Œcia squatter, little longer than broad.
 - α. Apertures wider; erect, unilaminar . 7. *B. coaxans*.
 - β. Apertures narrower; incrusting 8. *B. convexa*.
- B. Aperture nearly as large or as large as the intraterminal front wall; a secondary front wall is attained.
- I. Length rather less than 1 mm.; costæ about 6 or 7; intercostal fusions about 3.. 9. *B. hyla*.
 - II. Length rather more than 1 mm.; costæ about 4 or 5; intercostal fusions about 2.. 10. *B. ornata*.
- Unplaceable, but probably a *Batrachopora*, *Cellepora* (*Discopora*) *signata*, von Hagenow, 1851, Bry. Maastr. Kreid. p. 96, pl. x. fig. 17; Maastrichtian; Maastricht.
1. *B. [Cribrilina] perforata* (Marsson), 1887, Pal. Abh. vol. iv. Heft 1, p. 98, pl. x. fig. 11; *mucronatus*-zone; Rügen, Germany.
 2. *B. [Semiescharipora] ovalis* (d'Orbigny), Pal. Franç. 1852, pl. 719. figs. 13-16, 1853, p. 488; Senonian [Maastrichtian]; Royan, France.
 3. *B. royanensis*, sp. n.
- Type-specimen*. In the collection of M. Canu (a photograph of type-specimen in British Museum); Maastrichtian; Royan, France.
4. *B. crassa*, sp. n.
- Type-specimen*. British Museum, D. 16674; *mucronatus*-zone; Rügen, Germany.
5. *B. ranunculus*, sp. n.
- Type-specimen*. British Museum, D. 28838; *mucronatus*-zone; Rügen, Germany.
6. *B. aurita*, sp. n.
- Type-specimen*. In the collection of M. Canu (a photograph of type-specimen in British Museum); Maastrichtian; Royan, France.
7. *B. coaxans*, sp. n.
- Type-specimen*. British Museum, D. 14209; *mucronatus*-zone; Rügen, Germany.

8. *B. [Reptescharipora] convexa* (d'Orbigny), Pal. Franç. 1852, pl. 720. figs. 1-3, 1853, p. 492; Senonian [Campanian]; Meudon, France.

9. *B. hyla*, sp. n.

Type-specimen. British Museum, D. 11852; Maastrichtian; Maastricht.

10. *B. [Cellepora] ornata* (Goldfuss), 1826, Petr. Germ. vol. i. p. 26, pl. ix. fig. 1; Maastrichtian; Maastricht.

VII. PACHYDERA, MARSSON, 1887, Pal. Abh. vol. iv. Heft 1, p. 100.

Genotype. *P. grandis*.

Tabular Diagnoses of the Species.

- | | |
|---|------------------------|
| A. Secondary aperture, though well formed, hardly tubular; costæ 8-10, with about 3 lateral fusions | 1. <i>P. grandis</i> . |
| B. Secondary aperture distinctly tubular; costæ 6, with 1 or 2 lateral fusions | 2. <i>P. densa</i> . |
1. *P. grandis*, MARSSON, 1887, Pal. Abh. vol. iv. Heft 1, p. 100, pl. x. fig. 14; *mucronatus*-zone; Rügen, Germany.

2. *P. densa*, sp. n.

Type-specimen. British Museum, D. 28210; Danian; Faxø, Denmark.

[To be continued.]

XIII.—*Description of a new Genus of the Family Lacertidæ from Central Africa.* By G. A. BOULENGER, F.R.S.

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BEDRIAGAYA.

Head-shields normal. Nostril pierced between the nasal, a postnasal, and the first upper labial. Lower eyelid scaly. Collar well marked. Dorsal scales large, rhombic, imbricate, and keeled; ventral plates obtusely pointed, imbricate, and keeled. Digits compressed, with smooth scales inferiorly. Femoral pores. Tail long, cylindrical.

Intermediate between *Algiroides*, Bibr., and *Poromera*, Blgr. ; agreeing with the former in the dorsal lepidosis, with the latter in the ventral, in which it agrees also with *Gastropholis*, Fisch.

In proposing a name for this remarkable new genus, I have much pleasure in recalling the services rendered to herpetology, and particularly to the study of the Lacertidæ, by my esteemed friend Dr. J. de Bedriaga.

Bedriagaia tropidopholis.

Body moderately depressed. Head rather strongly depressed, but occipital region convex ; snout obtusely pointed. Pterygoid teeth absent. The hind limb reaches the elbow of the adpressed fore limb ; digits slender, somewhat bent at the articulations. Tail nearly three times as long as head and body. Nasals small, forming a very short suture behind the rostral ; frontonasal a little broader than long ; præfrontals forming an extensive suture ; frontal $1\frac{1}{2}$ times as long as broad, slightly shorter than its distance from the end of the snout, as broad as the supraoculars, but slightly broader in front than behind ; parietals $1\frac{1}{2}$ times as long as broad, outer border convex ; interparietal scarcely longer than broad, a little longer than the occipital, which is broader, nearly as broad as the frontal ; four supraoculars, first small, fourth larger and in contact with the upper temporal ; six superciliaries ; two granular scales between the supraoculars and the superciliaries. Postnasal forming a suture with the frontonasal ; five upper labials anterior to the subocular, which is as broad beneath as above ; two elongate upper temporals ; temporal scales rather large, subequal, obtusely keeled. Gular scales granular in front, larger and feebly keeled behind, with a median patch of gradually enlarged and imbricate scales in the middle towards the collar ; 24 scales in a straight line between the symphysis of the chin-shields and the median collar-plate ; no gular fold. Collar very strongly serrated, composed of 8 rather large plates. Scales on nape granular and keeled, on body large, rhombic, imbricate and diagonally keeled, passing gradually into the ventral plates ; 24 scales across the middle of the body. Ventral plates strongly imbricate, in 10 longitudinal and 33 transverse series. 6 præanal plates. 12-13 femoral pores. 30 lamellar scales under the fourth toe. Caudal scales keeled and pointed behind. Bluish green above and beneath (in spirit), darker on the back ; eight longitudinal series of small round light spots on the nape and back, with small black spots between them ;

XV.—One new Starfish and Five new Brittle Stars from the Galápagos Islands*. By AUSTIN H. CLARK.

Freyella scalaris, sp. n.

Fourteen or fifteen arms; R=about 150 mm.; diameter of disk 18 mm. to 22 mm.; diameter of elevated portion of disk 15 mm. to 19 mm.; length of genital region twice the diameter of the disk; diameter of ray at base 5 mm.; diameter of ray at widest part of genital inflation (15 mm. from the base) 6 mm.

The edge of the disk is circular, with slight indications of lobes on the arm-bases. The abactinal membrane is very tight, covered with very small and numerous thin and delicate plates which are thickly beset with very small and fine evenly spaced spinules, each entirely encased in a membranous sheath; there are a few longer spinules about the anal opening.

The madreporite is small, subcircular, situated on the border of the raised portion of the disk, surrounded by numerous spinelets, which form a rather large patch on the adcentral side.

The interradial plates, which are confined to the side-wall of the disk, are high and narrow, nearly twice as high as broad, inconspicuous.

The rays are very long, narrow, tapering gradually, only slightly narrower at the base than throughout the very extensive genital region, which is not inflated; they are subcylindrical at the base, and are little or not at all depressed on the genital region.

The genital region extends along the arm for a distance equal to twice the diameter of the disk. From the base of the rays to the distal border of the genital region the abactinal surface of the arms is covered, and completely enclosed, by rounded-quadrate irregularly imbricating plates, arranged in fairly regular transverse rows. Across the arm in the centre of the plates composing each of these rows there runs a regular band of small spines, which are more than twice as long as the spines on the disk and mostly or entirely naked. At the arm-bases these rows are closely crowded and the spines are relatively small, but they rapidly become more spaced and the spines increase in length; over the genital region from fifty-five to sixty of these prominent spiniferous

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transverse ridges may be counted, which are from 0.6 mm. to 0.8 mm. apart. Each of the plates in the transverse rows bears from four to seven spines, usually in a somewhat irregular single median linear series; occasionally one of the spines may be more or less enlarged. Among these spines are many minute pedicellariæ.

Except where it is supported by plates the abactinal membrane, which is very thin, is collapsed upon the ambulacral ridge, which is plainly visible through it.

Beyond the genital region the transverse bands of plates become more widely spaced, separated from each other by a band of naked skin, the spines at the same time becoming reduced to a narrow band of pedicellariæ. There is a narrow transverse band of plates over the lines of union between all the ambulacral ossicles, and another over their central portion. These bands become narrower and the plates composing them more delicate, but they persist to the end of the arms.

The adambulacral plates at first are broader than long, becoming longer than broad after the proximal half of the genital region, and very narrow and elongate distally. On the furrow-margin they bear two very delicate spines, one at either end of the plate, which reach halfway across the furrow and are covered with a delicate membrane bearing one or two pedicellariæ. On the aboral end of the plate above, and somewhat proximal to, the distal furrow-spine there is a much longer and stouter spine, twice as long as the furrow-spines and correspondingly stout, sheathed in membrane and bearing numerous pedicellariæ. Beyond this and slightly proximal to it, situated approximately on the actinolateral border of the plate, there is a long stout spine nearly double the length of the preceding, enshrouded in thick membrane covered with very numerous pedicellariæ; as far as the end of the adoral fourth of the genital region the end of this spine is expanded into a club-like, bifurcate, or bluntly three- or four-pointed tip, but beyond this point the tip is slender and sharp. On the abactinal border, mounted on a small truncated conical plate affixed to the adambulacrals, there is a long slender sharp spine, longer than the preceding, sheathed in thin membrane.

The mouth-spines are two, thickly beset with pedicellariæ.

The colour in alcohol is brownish yellow.

Type. Cat. no. 36950, U.S.N.M., from 'Albatross' Station 2807, Galápagos Islands, in 812 fathoms.

Astrodendrum galapagensis, sp. n.

The disk is 7 mm. in diameter, strongly excavate in the interbrachial regions.

This species appears to be related to *A. sagaminum* (Döderlein), from which it differs in the following particulars: the granulation of the disk and arms is much coarser, the granules being rather widely scattered, so that on the disk the major part of the surface is naked integument; the granulation of the interbrachial spaces below is closer than in *A. sagaminum*, and the granules are all subequal instead of being of two distinct sizes, larger (and fewer) and smaller (and more numerous), as in *A. sagaminum*.

Beneath, except in the interbrachial spaces, there are only a few small and widely scattered granules.

The first arm-branch appears to consist of eight or nine segments, the second of ten.

Type. Cat. no. 38581, U.S.N.M., from 'Albatross' Station 2818, among the Galápagos Islands, in 392 fathoms.

Ophiacantha cyrena, sp. n.

The disk is 8 mm. in diameter; the arms are 50 mm. long.

The radial shields are visible just above the arm-bases as small broad triangles with the outer angles broadly rounded; their length is less than half as much again as the greatest width (which is just within the border of the disk); the inner half of the distal border is produced slightly beyond the edge of the disk, and is strongly convex; this convexity is carried backward for some distance in the inner half of the plate; there is a more or less pronounced elevation of the median portion of the proximal half of each radial shield. The radial shields of each pair are separated interiorly by a wedge-shaped mass of plates with only slightly converging sides, which at the border of the disk is usually about half as broad as the length of the distal border of the shields.

Except for the small radial shields the disk is covered with rounded, subequal, overlapping plates, each of which bears a short truncated spine arising from an expanded circular base; these spines increase slightly in diameter from the bottom to the top, and bear numerous small spinules along their sides, which increase in length outwardly and form a prominent thorny crown. Some of the scales in the wedge separating the radial shields of each pair are much larger than the others, and than those of

the remainder of the dorsal surface of the disk ; few or none of the scales in this area bear spines.

The interbrachial areas below and on the sides of the disk are covered with small rounded imbricating scales which do not bear spines.

The oral shields are, roughly, triangular ; the inner angle is slightly more than a right angle ; the outer angles are very broadly rounded ; the median third of the distal border is occupied by a rather high, rounded, posterior process.

The side mouth-shields are not quite in contact interiorly ; they are narrow, with the proximal and distal borders diverging only very slightly, the lateral angles somewhat produced, and with a narrow posterior process enveloping the broadly rounded outer angles of the oral shields.

The mouth-papillæ are five (rarely six) in number ; the innermost is more or less spatulate, about twice as long as the maximum width, broadly rounded distally ; the three following become progressively more and more slender ; the outermost is broader again (about of the same proportions as the second) with the outer part more or less bent toward the apex of the jaw.

One or two tooth-papillæ may be present.

The upper arm-plates are fan-shaped, broader than long, with produced lateral angles and a rather sharply rounded distal angle ; they are separated from each other the entire length of the arm by the union of the side arm-plates.

The arm-spines are from seven to nine in number, slender, very strongly flattened, and very finely spinous ; the two uppermost are the longest (3 mm. in length on the proximal segments), the others decreasing in length and becoming very slender.

The second under arm-plate is slightly broader than long, with the distal border gently convex ; the following increase very slowly in length, so that the fifth is about as long as broad with a strongly and evenly convex distal edge, and the remainder are slightly longer than broad with an almost semicircular distal border and the proximal border in the form of an obtuse angle, delimited by the distal ventral borders of the side arm-plates.

There is one broad, leaf-like, sharply pointed tentacle-scale with serrate edges ; over the first two or three arm tentacle-pores there are two scales, narrower and less pointed distally than those beyond, the inner the smaller.

Type. Cat. no. 38582, U.S.N.M., from 'Albatross' Station 2818, among the Galápagos Islands, in 392 fathoms.

Ophiacantha similis, sp. n.

This species is very nearly related to *O. moniliformis*, Lütken and Mortensen, from which it differs in the following particulars:—

The oral shields have an evenly curved distal border, quite without the process so characteristic of *O. moniliformis*, and a proximal border which is either a straight line or two gently concave lines meeting in the centre to form a point between the bases of the side mouth-shields.

The side mouth-shields are much larger than those of *O. moniliformis*, and very different in shape; their internal apposed edges are unusually long; on reaching the oral shield these turn abruptly and run in a slightly curved, sometimes almost straight, line to the first under arm-plate; frequently the distal borders of the side mouth-shields, which are about as long as the apposed borders, are approximately straight, making a right angle with the latter; the outer borders make a regular curve from the inner apposed blunted apices to the outer, similarly blunted, apices, which are in contact with the distal portion of the first under arm-plate. The side mouth-shields therefore resemble in shape stout crescents with blunted ends or boomerangs. They lie entirely within the lateral angles of the oral shields.

The mouth-papillæ are slightly shorter and stouter than the corresponding structures in *O. moniliformis*.

One or two tooth-papillæ are exceptionally present.

The teeth are much broader than those of *O. moniliformis*.

The side arm-plates are markedly shorter than in *O. moniliformis*, and the arm-segments are much less swollen distally; the arm-spines, five or six in number, are much shorter than those of *O. moniliformis* and noticeably stouter.

Type. Cat. no. 38583, U.S.N.M., from 'Albatross' Station 2818, among the Galápagos Islands, in 392 fathoms.

Ophiolebes mortenseni, sp. n.

The diameter of the disk, which is rounded-pentagonal, is 5.5 mm.

The disk is covered with moderately large scales of very uniform size, each of which bears a short cylindrical stump terminating in a tuft of thorns. There is sometimes to be seen on one or both sides of the arm-bases a narrow linear streak free of scales and stumps, which indicates the position of the radial shield. The disk closely resembles that of *O. vestitus*, Lyman, but the processes are cylindrical with

rounded thorny summits, instead of being more or less conical.

The arm-spines are six in number, finely spinous, the uppermost the longest, the following regularly decreasing in length as in *O. vestitus*; the longest arm-spine (the uppermost on the second side arm-plate beyond the disk) is 1.5 mm. long.

The arms and the structures about the mouth do not seem to differ from the corresponding parts in *O. vestitus*.

Type. Cat. no. 38585, U.S.N.M., from 'Albatross' Station 2818, among the Galápagos Islands, in 392 fathoms.

Ophiophyllum marginatum, sp. n.

The disk is approximately circular, 7.5 mm. in diameter, flat, and very thin, with the central portion covered with rather large, subequal, rounded, slightly imbricating scales.

The arms are all broken, but were apparently short, tapering rapidly from the base, strongly flattened, and low triangular in section. The diameter of the arms at the base is 1.75 mm.

In each interbrachial space there is a conspicuous fringe-like border consisting of from eight to ten (usually nine or ten) fish-scale-like plates, always with a central pair, which increase in size and length outward from the median line. The plates of the central pair are oblong, with the outer corners slightly rounded, slightly broader than high to one-third again as broad as high; the plates of the next pair are rhombic, slightly larger than those of the central pair, all of the sides the same length, the angles slightly rounded; the plates of the following pair are more oblique than those of the second pair, and are markedly higher than broad; the plates of the succeeding pair are larger, with a straight inner, but more or less curved outer, border, and a slightly curved free outer edge, in shape not unlike the primary (fore wing) of a butterfly; the plates of the outermost pair are triangular, with the outer sides and the distal apex rounded, the latter reaching to the outer corner of the plate of the preceding pair. The plates of each pair dorsally overlap the inner borders of the plates of the succeeding pairs. The distal borders of these marginal plates form a very slightly curved line between the arm-bases, in contrast to the much more strongly curved border of the disk. The outer sides of the plates of the outermost pair only slightly overlap the outer proximal corners of the first side arm-plates.

The radial shields are large and are roughly ovoid in outline. From a point at the base of the arm they curve regularly outward to the median interr radial plates, their free borders supporting the outer two or three marginal plates; from their broadly rounded ends they curve inward, their inner sides being approximately parallel, until the level of the inner end of the median broad plate of the interr radial column is reached, when they curve more rapidly inward and then outward to the arm-bases.

An elongate, rounded, triangular plate separates the radial shields, except just at the arm-bases.

The interr radial portion of the disk between the distal portion of the radial shields is covered with a large single plate about half as large as a radial shield, which has strongly slanting sides and a curved inner border, which is about as long as the two lateral borders or half as long as the outer border. This plate (which supports the two central pairs of marginal scale-like plates) is joined with the plates of the central region of the disk by a triple column of plates, consisting of a broad and elongate central plate, on either side of which is a column of two (rarely three) similar plates placed end to end only half as broad as the central plate.

The ventral interr radial areas of the disk are occupied by ten or a dozen plates, usually two or three large ones on either side, with an irregular column of much smaller plates between them.

The genital slits are long, extending from the side mouth-shields nearly to the edge of the disk. The genital plates are prominent, rather wide, reaching from the lateral border of the oral shields to the periphery of the ventral surface, increasing in width outwardly.

The oral shields are transversely oval, about twice as broad as long, the proximal border forming a slightly obtuse angle.

The side mouth-shields are very narrow, in contact inwardly, running slowly to a point at the base of the genital slit.

The mouth-papillæ form a narrow continuous band of uniform height, with a straight outer profile; they are six in number, the innermost about as long as broad, the next three increasing regularly in length, and the two outermost much longer, about four times as long as high.

There are from two to four conical tooth-papillæ.

The teeth are long and sharp, triangular.

The upper arm-plates are very narrow, triangular, about twice as long as broad; the outer border is rounded, in

length about one-fourth the width of the arm, overlapping slightly the base of the succeeding upper arm-plate; beyond the seventh the upper arm-plates are separated for an increasingly large distance by the dorsal apposition of the side arm-plates.

The side arm-plates are very large, with the dorso-lateral border forming a sharp keel which is produced into a thin knife-like border, increasing in height distally.

Within the sharp point formed by the outer corner of the side arm-plates is a single, flattened, very thin spine, about half as long as the segment, at first leaf-like, soon becoming triangular, which is closely appressed to the arm and overlaps the proximal part of the succeeding side arm-plate; viewed from below this spine forms a perfect continuation of the lateral production of the side arm-plate.

The first under arm-plate is a slightly shortened pentagon with strongly concave sides and sharply rounded corners; the next is six-sided, elongate, the lateral edges strongly concave, the proximal angle truncated by the first, the distal angle overlapping the base of the third, the proximal and distal borders concave; the following rapidly decrease in size, becoming smaller and separated from each other by the apposition of the side arm-plates.

There are two strongly curved tentacle-scales forming between them a funnel enveloping the base of the tentacle.

The first arm-tentacle lies just beyond the distal end of the mouth-frames, between the side mouth-shields and the first under arm-plate.

Type. Cat. no. 38584, U.S.N.M., from 'Albatross' Station 2818, among the Galápagos Islands, in 392 fathoms.

XVI.—*On Paragnathia, a Genus of the Crustacean Family Gnathiidae.* By W. OMER COOPER, F.L.S.

[Plate VI.]

IN the course of collecting along the shores of Christchurch Harbour, Hants, in May 1915, I came across a number of colonies of *Gnathiidae*, consisting principally of specimens in the late *Praniza* stage and of a brilliant green or yellow colour. They were at first taken to be *Gnathia maxillaris* (Mont.), but upon a more careful examination it became apparent that they belonged to the species described by Bate and Westwood under the name of *Anceus halidaii*, and

identified by Canon Norman with the *Anceus formica* of Hesse. The description by Bate and Westwood proved, upon comparison with my specimens, to be very accurate and left no doubt whatever as to the identity of the species, but I am by no means inclined to believe that this can be the same animal which Hesse described under the name of *Anceus formica*. This latter species is described as having a distinctly rounded head, gnathopods consisting of a single flattened plate, and a rounded telson, none of which features in any way agree with the description given by Bate and Westwood or with my specimens.

Upon a microscopical examination of the mouth-parts it became apparent that this species is very widely separated from the others belonging to the genus *Gnathia*, among which it has, of course, been formerly placed. The five-jointed gnathopods of both male and female and the absence of maxillipeds in the latter at once distinguish it from all other species of *Gnathia*, and the former characters, at least, would appear to be of more than specific value as the opercular two-jointed gnathopods are one of the most distinctive features of the genus. I therefore consider it best to place this species in a new genus, *Paragnathia*, very closely allied to *Euneognathia* (Stebbing), the only important distinction being that the latter has the gnathopods of the male six-jointed. As, however, no female of the only known species of this genus—*Euneognathia gigas* (Beddard)—appears to have been described, it would seem probable that the females of the two genera might show further distinguishing features, more especially as *E. gigas* and *P. halidaii* are specifically very widely separated.

Since my first discovery of *P. halidaii* at Christchurch Harbour, I have found the species there in great abundance, and I have also had it sent to me from near Plymouth and from St. Andrews. It is probably more or less widely distributed, but may easily be passed over on account of its almost terrestrial mode of life. It would seem to be always found where the water is more or less brackish, living in small cavities in the banks just below high-water mark, and a considerable number of specimens are usually found together in each cavity, the males apparently having small holes leading from these cavities, into which they retire in case of danger. They are exceedingly sluggish in their habits, and when frightened they usually sham death, folding their legs close to their body. As in the case of *Gnathia*, there is nothing to show that the adults ever eat, and the use of the peculiar mouth-organs is unknown. The

larvæ, like those of the Gnathiidæ, are parasitic on fish; chiefly on the small flat fish which are frequently so plentiful in somewhat brackish water; they are most easily identified by the shortness of the last abdominal segment and by the eight-jointed flagellum of the inferior antennæ.

As there does not appear to be any good modern description of this species, I give one below, drawn up from an examination of specimens from Christchurch Harbour, together with a definition of the genus *Paragnathia*.

Genus PARAGNATHIA.

J. & W. Omer Cooper, Zoologist, (4) xx., January 1916, p. 26.

Flagellum of inferior antennæ eight-jointed. Male with mandibles and maxillipeds similar to those in *Gnathia*; maxillipeds absent in female. First pair of peræopods (gnathopods) in male consisting of five flattened joints only partially covering the oral area; in the female with five subequal and similar joints, opercular plate absent.

Genotype. *Anceus halidaii*, Bate and Westwood.

As in *Gnathia*, the superior antennæ have the peduncle three-jointed, the flagellum five-jointed in the male, four-jointed in the female and larva. The inferior antennæ have the peduncle four-jointed; the eight-jointed flagellum is one of the points of resemblance between this genus and *Euneognathia*.

Paragnathia halidaii (Bate and Westwood).

(Pl. VI. figs. 1, 2.)

Anceus halidaii, Bate and Westwood, British Sessile-eyed Crustacea, ii. 1868, p. 203.

Gnathia formica (non *Anceus formica*, Hesse), Norman, Ann. & Mag. Nat. Hist. (7) xvi. 1905, p. 86.

Male. Body somewhat elongated, about five times as long as its greatest breadth; head subquadrangular; eyes well developed; anterior part of thorax without areolation, divided from the posterior by a fairly deep constriction; fifth thoracic segment (third free segment) clearly separated from the following; abdomen much narrower than thorax, sides straight, slightly decreasing in breadth towards the telson, terminal segment short, triangular, not reaching further than the middle of the uropods, provided with two setæ at the apex. Superior antennæ reaching as far as the middle of the flagellum of the inferior, which are about the same length as the head; peduncle of the superior antennæ

consisting of three stout subequal joints, that of the inferior pair with the first two joints short and strong, the third joint slightly shorter than the fourth which is about twice the length of the second, the fourth joint increasing in size distally, and, together with the second and third joints of the superior antennæ, provided with numerous tufted sensory hairs. Mandibles somewhat small and of a simple form, with a small notch on the outer edge and with about seven strong distinct teeth at the extremity. Maxillipeds with the basipodite large and rounded, slightly longer than the palp, which consists of four small joints provided with numerous long plumose setæ along their outer edges; the endite of the basipodite of a regular oval shape, distinctly jointed at the base, and provided with nine coupling-hooks along the inner edge. First pair of peræopods (gnathopods) consisting of five flattened joints, ciliated on both edges and provided with a few long and stout setæ; the first joint about two-thirds as broad as its length, the second very small, the third and fourth together equal in length to their breadth and a little longer than the first joint, the fifth joint small, more than twice as long as it is broad; the other five pairs of peræopods adapted for walking, terminating in a stout claw, the third, fourth, and fifth joints with a few spines on the inner surface. Pleopods without setæ, the outer branch terminating in a short spine. Uropods fringed with a few long setæ. External sexual organ stout, bilobed at the extremity. Length 5 mm. Colour dirty-white to brown.

Female. Body rounded, head short and subtriangular; eyes rather large; last abdominal segment short and triangular. First pair of peræopods (gnathopods) somewhat short and flattened, the last joint much smaller than the others and bearing one or two setæ, the other joints having numerous short stout spines along their edges; other appendages as in the male. Length 4 mm. Colour grey.

Larva. Mouth-parts suctorial; mandibles, maxillæ, and maxillulæ styliform; maxillipeds serrated on the inner edge, palp two-jointed. First pair of peræopods terminating in a stout claw, having a small tooth near the base; others as in adult. Pleopods fringed with setæ. Length on leaving brood-pouch 1.5 mm. Colour in late praniza stage bright green or orange.

Distribution. St. Andrews; Christchurch Harbour; Plymouth; Strangford Lough, Ireland (*Bate and Westwood*); Roscoff (*Delage*).

XVII.—*Descriptions of New Pyralidæ of the Subfamilies*
Epipaschianæ, Chrysauginæ, Endotrichinæ, and Pyralinæ.
 By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c.

THE numbers attached to the species in the following paper refer to my classification of the *Epipaschianæ*, *Endotrichinæ*, and *Pyralinæ* in the Trans. Ent. Soc. 1896, pp. 451 to 550, and *Chrysauginæ* in the P. Z. S. 1897, pp. 633 to 692, and subsequent supplementary paper in the 'Annals and Magazine of Natural History.'

Pyralidæ.

EPIPASCHIANÆ.

(3b) *Pococera strigidiscalis*, sp. n.

♀. Head, thorax, and abdomen pale red-brown mixed with whitish; antennæ blackish; tarsi blackish brown ringed with white. Fore wing olive-ochreous tinged with reddish mixed with some white and a few black scales; subbasal whitish striæ from costa and cell with some black scales beyond them; traces of a diffused white antemedial line with some black scales before it in submedian interspace; traces of an oblique sinuous white medial line; a white patch in and beyond end of cell with an oblique black discoidal striga formed of raised scales on it, some black scales on the outer edge of the patch and blackish marks below it above and below vein 1; subterminal line white, defined on inner side by black points and with more prominent spot at inner margin, excurved at middle, some reddish-brown suffusion with some black scales on it beyond it on costal area; a terminal series of minute quadrate black spots; cilia pale red, chequered with white towards tornus. Hind wing semihyaline whitish, the veins tinged with brown; the costal area and termen suffused with brown, the latter narrowing to a point at vein 2; a terminal black line; cilia pale red with a white line at base to vein 2, then whitish.

Hab. FR. GUIANA, St. Laurent Maroni, 1 ♀ type. *Exp.* 26 mm.

(3c) *Pococera mediosinalis*, sp. n.

♂. Head and thorax whitish suffused with olive-brown; antennæ blackish, the shaft whitish towards base; abdomen grey suffused with olive-brown and banded with blackish; tarsi except 1st joint black ringed with white. Fore wing olive-brown, the basal area with some whitish and some black irroration above base of inner margin; antemedial line black, obliquely excurved to submedian fold, then slightly incurved and defined on each side by white; a small black discoidal spot surrounded by whitish; a curved series of minute black spots beyond the cell between discal and submedian folds; postmedial line black, slightly defined on outer side

by whitish, excurved between discal and submedian folds; the terminal area whitish towards apex, a terminal series of black points. Hind wing semihyaline white irrorated with brown; the terminal area suffused with brown towards apex; a dark terminal line; cilia white with a brown line near base; the underside with the costal area irrorated with brown, an oblique brown discoidal striga and curved postmedial line from costa to vein 2.

Hab. COLOMBIA, Rio Derg, 1 ♂ type. *Exp.* 18 mm.

(7j) *Pococera arciferalis*, sp. n.

Palpi very long, the 2nd joint fringed with hair above; antennæ of male fringed with hair above at middle.

♂. Head and thorax ochreous tinged with red and mixed with black-brown; palpi fringed with black-brown hair above; pectus and legs redder; abdomen ochreous tinged with red and obscurely banded with blackish brown, the ventral surface red. Fore wing ochreous tinged with red, suffused with brown and irrorated with blackish; a blackish medial line with a broad ochreous band tinged with red before it; an obliquely curved black discoidal lunule and a blackish patch below end of cell; an evenly curved black line from costa beyond middle to tornus with narrow ochreous band on its outer side; a strong black terminal line; cilia ochreous with a blackish line at middle, the tips reddish towards apex. Hind wing semihyaline whitish, the apical area suffused with brown; a terminal series of blackish striæ; cilia tinged with red towards apex.

Hab. W. COLOMBIA, San Antonio (*Palmer*), 2 ♂ type. *Exp.* 28 mm.

(7n) *Pococera metaxanthalis*, sp. n.

♀. Head and thorax rufous; antennæ dark brown except towards base; palpi with dark brown mixed; abdomen with the base yellowish tinged with rufous, the terminal half blackish irrorated with whitish, the anal tuft rufous; legs rufous, the fore legs irrorated with blackish, the hind tibiæ fringed with ochreous hair. Fore wing rufous slightly tinged with grey and irrorated with blackish; a blackish fascia on base of inner margin; a small black-brown antemedial spot in the cell and two larger spots in submedian interspace; a small black-brown discoidal spot; a faint dark postmedial shade, oblique to discal fold, then inwardly oblique; traces of dentate blackish subterminal marks defined on outer side by whitish from discal fold to inner margin; some black points on termen towards apex and small spots above and below vein 2. Hind wing golden yellow, the terminal area fuscous, broadly at costa, narrowing to tornus; cilia whitish mixed with fuscous. Underside of fore wing fuscous, the costa rufous, expanding into a patch before apex; hind wing with the costal area fuscous, the costal edge fringed with rufous hair.

Hab. COLOMBIA, Choko Prov., Condoto (*Spurrell*), 1 ♀ type. *Exp.* 32 mm.

(10 b) *Pococera fuscifusalis*, sp. n.

♀. Head ochreous whitish, the 3rd joint of palpi and antennæ fuscous; thorax ochreous, suffused with fuscous except the tegulæ in front and shoulders; pectus and legs ochreous, the fore and mid femora at extremities and tibiæ at base blackish; abdomen ochreous dorsally suffused with rufous. Fore wing ochreous tinged with red, the terminal area suffused with red, broadly on apical area, the costal half suffused with fuscous black to end of cell, extending at base to vein 1 and with oblique outer edge produced to a point beyond lower angle of cell; a diffused blackish spot below middle of cell, and another rather nearer the base on inner margin; traces of a double medial line, oblique to submedian fold, then inwardly oblique and sinuous; a curved minutely dentate red subterminal line; a terminal series of black points; cilia whitish at tips. Hind wing ochreous whitish tinged with brown, the terminal area suffused with brown narrowing to tornus; cilia whitish at tips.

Hab. FR. GUIANA, St. Laurent Maroni, 1 ♀ type. *Exp.* 24 mm.

(10 c) *Pococera seminigralis*, sp. n.

♂. Head and thorax rufous with a few dark brown scales except on tegulæ; antennæ blackish except towards base; palpi with black spot in front of 2nd joint at middle; abdomen whitish tinged with rufous and with blackish segmental bands; pectus, legs, and ventral surface of abdomen pale rufous, the tarsi black ringed with whitish. Fore wing pale rufous suffused with fuscous and slightly irrorated with black to the postmedial line; a subbasal black striga below the cell; minute black-brown spot in middle of cell and tuft of raised black-brown scales below middle of cell; a double oblique black line filled in with whitish from submedian fold below end of cell to inner margin, slightly angled inwards at vein 1; postmedial line strong, black, oblique, with another black line beyond it from costa to discal fold; subterminal line pale, faintly defined on each side by rufous, rather obliquely incurved to discal fold, then minutely dentate to vein 2, then double blackish filled in with whitish and oblique to inner margin, a deeper rufous patch beyond it on costa and some greyish on terminal area below apex; a terminal series of black striæ and a series of black points near base of cilia which are chequered with fuscous towards apex. Hind wing white with a reddish-brown tinge, the inner area browner towards tornus, the apical area and veins towards termen dark brown; a minute subterminal black spot on vein 2; cilia with a punctiform brown line near base; the underside with blackish discoidal point, oblique punctiform postmedial line from costa to vein 4 and red-brown apical patch.

Hab. PERU, R. Ucayale, Contamino, 1 ♂ type. *Exp.* 22 mm.

(13 a) *Pococera mesoleucalis*, sp. n.

♀. Head and thorax white with an ochreous tinge; palpi with the 3rd joint black except at tip; antennæ brown; pectus and legs white suffused with brown, the tarsi ringed with white; abdomen white with obscure dorsal segmental blackish bands, the extremity red-brown. Fore wing with the basal area white suffused with brown with a golden cupreous gloss, defined by the blackish antemedial line which is excurved below submedian fold; medial area pure white with some brown irroration on costa; a small black spot in middle of cell and elliptical discoidal spot; the outer edge of the white area produced to a point beyond lower angle of cell and defined by traces of a blackish postmedial line; the terminal area brown with a cupreous gloss; cilia with white line at base and white tips. Hind wing pure white, the terminal area suffused with cupreous brown narrowing to a point at tornus; cilia with a white line at base and white tips.

Hab. FR. GUIANA, St. Laurent Maroni, 1 ♀ type. *Exp.* 22 mm.

(1f) *Lepidogma minimalis*, sp. n.

♀. Head, thorax, and abdomen white tinged with brown, the head more fuscous; palpi fuscous black with a few white scales; fore legs suffused with fuscous, the tarsi black ringed with white. Fore wing white tinged with brown and irrorated with blackish; an antemedial black point below the cell; a black medial shade from costa to vein 1; a blackish discoidal striga with a patch of blackish irroration above it on costa; the costa blackish towards apex; a dark subterminal shade except towards inner margin; some blackish points on apical half of termen. Hind wing semi-hyaline brownish white.

Hab. CEYLON, Peradeniya, 1 ♀ type. *Exp.* 12 mm.

(3c) *Lepidogma melanospila*, sp. n.

♀. Head and thorax ochreous tinged with red-brown; antennæ with the shaft ringed with dark brown; palpi with the 3rd joint black at base; tarsi black ringed with white; abdomen ochreous suffused with red-brown, the extremity brown with a whitish band before it, the ventral surface white. Fore wing ochreous tinged with red-brown, especially on medial and terminal areas, and irrorated with blackish; a black point in middle of cell and discoidal striga of raised black scales; postmedial line rather diffused, red-brown defined on outer side by a narrow ochreous band, excurved at middle; a terminal series of black striæ; cilia rufous with an ochreous line at base. Hind wing ochreous suffused with red-brown; a diffused curved dark postmedial line between veins 4 and 2 defined on outer side by whitish; a terminal series of black striæ; cilia rufous with a fine ochreous line at base; the underside whitish

tinged with red and irrorated with brown, a curved brown post-medial line, the terminal area suffused with brown, narrowing to a point before tornus.

Hab. GOLD COAST, Bibianaha (*Spurrell*), 1 ♀ type. *Exp.* 20 mm.

(5) *Lepidogma chrysochloralis*, sp. n.

Fore wing with vein 7 from 8 before 9; male with antemedial tuft of hair in the cell.

♂. Head and tegulæ white mixed with bright rufous, the tegulæ with golden-green patches at middle of tips; palpi pale green with the 3rd joint dark brown; patagia golden-green with rufous tips, the dorsum of thorax white and rufous; pectus and legs ochreous tinged with rufous, the tarsi blackish with pale rings; abdomen bright rufous, the ventral surface ochreous white. Fore wing golden green; a bright rufous patch at base of inner area; a broad rufous antemedial band not quite reaching inner margin; a slight rufous medial line, somewhat excurved at the discocellulars where there is some rufous suffusion beyond it; postmedial line rufous, with small spot at costa, slightly bent outwards below costa, then minutely waved to vein 4, then bent inwards and with rufous band before it to inner margin, some black on the line towards inner margin; a rufous subterminal band, broad except at middle where it is constricted, some black on its inner edge towards inner margin; a terminal series of small rufous spots; cilia ochreous and rufous. Hind wing red-brown; cilia ochreous tinged with rufous; the underside whitish towards base.

Hab. DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♂ type. *Exp.* 20 mm.

(1 b) *Jocara albiferalis*, sp. n.

Antennæ of male with the process long and thickly scaled; fore wing with the apical part of costa dilated into a lobe clothed with downturned scales.

♂. Head, thorax, and abdomen ochreous tinged with rufous; antennæ with the hair towards extremity of the process blackish, the shaft black; tarsi blackish towards extremities. Fore wing with the basal area ochreous irrorated with fuscous brown, extending on costa to beyond middle, the rest of wing fuscous brown with a rounded creamy-white postmedial patch on inner area; traces of an oblique sinuous ochreous line defined on outer side by fuscous from submedian fold below end of cell to inner margin; a very indistinct pale waved subterminal line, excurved to vein 4, then incurved. Hind wing creamy white, the termen fuscous brown, broadly to vein 2, then narrow; cilia creamy white at tips; the underside with the costa irrorated with brown, a small spot at upper angle of cell, and indistinct postmedial line from costa to vein 2.

Hab. FR. GUIANA, St. Laurent Maroni, 1 ♂ type. *Exp.* 26 mm.

(1e) *Jocara hemizonalis*, sp. n.

Antennæ of male with the process long and thickly scaled; fore wing with antemedial fan of scales from median nervure.

♂. Head and thorax ochreous tinged with rufous; antennæ with the process bright rufous; the shaft fuscous; palpi with the 3rd joint blackish; tarsi blackish with pale rings; abdomen reddish ochreous, dorsally tinged with brown towards base. Fore wing ochreous tinged with rufous and olive-green; the base obliquely irrorated with blackish scales; the tuft of scales from median nervure tipped with black; a blackish medial line, minutely waved to median nervure, then defined on inner side by ochreous with a rufous band before it, slightly angled inwards on vein 1 and excurred below it; a point of raised black scales on discocellulars; a curved minutely dentate blackish subterminal line; a series of minute black spots just before termen; cilia with a series of slight fuscous spots near base. Hind wing ochreous tinged with brown and the inner area with rufous; the terminal area suffused with brown and rufous, narrowing to tornus; a subterminal series of dark points on the veins from costa to vein 2, defined on outer side by ochreous; a terminal series of black stræ; cilia ochreous and rufous; the underside whitish, the costal area ochreous irrorated with red, the terminal area suffused with red, a dark point at upper angle of cell and curved subterminal line except towards inner margin.

Hab. PERU, Cushi, 1 ♂, El Porvenir, 1 ♂ type. *Exp.* 36 mm.

(1j) *Jocara lactiferalis*, sp. n.

♀. Head, thorax, and abdomen ochreous tinged with rufous; antennæ fuscous; tarsi blackish with slight pale rings. Fore wing ochreous suffused with rufous, the basal area more ochreous; the tuft of scales below middle of cell tipped with blackish and with a rufous patch below it; a slight dark medial line, below the cell sinuous and defined on inner side by ochreous; a discoidal point of raised black scales; a curved minutely dentate brownish subterminal line defined on inner side by ochreous; a terminal series of minute black spots; cilia with a fuscous line near base. Hind wing ochreous suffused with reddish brown; cilia reddish ochreous with a brown line near base, the underside ochreous whitish, the costal and terminal areas suffused with red-brown, a dark point at upper angle of cell and diffused curved postmedial line.

Hab. COLOMBIA, Sierra del Libano (*H. H. Smith*), 5 ♀ type. *Exp.* 24 mm.

(1p) *Jocara thermochroalis*, sp. n.

♂. Head and thorax red slightly mixed with ochreous and black; palpi and basal joint of antennæ black, the latter with the shaft brown; pectus and legs ochreous mixed with red, the tarsi black ringed with ochreous; abdomen ochreous tinged with red

and irrorated with brown. Fore wing deep vinous red irrorated with whitish, the basal and medial areas thickly irrorated; a sub-basal black streak below the cell; antemedial line whitish, waved, defined by some black scales; a black discoidal bar; the outer edge of the whitish medial area defined by black scales beyond and below the cell, angled outwards beyond lower angle of cell, then retracted and excurved above inner margin; postmedial line blackish defined on outer side by whitish, excurved below costa, then minutely dentate; a terminal series of black striæ; cilia with blackish lines near base and tips. Hind wing white, the inner area tinged with red, the apex suffused with brown; a dark terminal line; the underside with the costal area irrorated with brown, a small blackish discoidal spot, and indistinct postmedial line excurved below costa, then with minute dark streaks on the veins.

Hab. COLOMBIA, San Antonio (*Palmer*), 2 ♂ type. *Exp.* 30 mm.

(1 q) *Jocara rufiapicalis*, sp. n.

♂. Head and tegulæ rufous mixed with whitish; antennæ with the shaft fuscous, the process with some black hair on inner side towards extremity; thorax whitish, the patagia with some black scales towards base; pectus and legs white mixed with rufous, the tarsi rufous ringed with white; abdomen white tinged with ochreous and irrorated with black except on ventral surface. Fore wing silvery white irrorated with pale brown, the basal area reddish ochreous with sinuous outer edge; a reddish-ochreous antemedial patch from costa to below the cell, with some black on its inner side in and below the cell and an excurved brownish line defined on inner side by white from it to inner margin; a small round black discoidal spot with some reddish ochreous above it on costa; postmedial line brown defined on outer side by white, excurved below costa, then minutely waved and incurved in submedian interspace, a wedge-shaped rufous patch beyond it on costal area with a white point defined on each side by black on the costa; the terminal area irrorated with grey; a terminal series of black striæ; cilia white with black points at the veins. Hind wing white, the terminal area suffused with red-brown from apex to submedian fold; a reddish discoidal bar; a postmedial series of deep reddish points on veins 5 to 2; a terminal series of blackish points; cilia white with black points at the veins; the underside with the costal area and terminal area to vein 2 suffused with red, a small black discoidal spot, and curved postmedial line from costa to submedian fold.

Hab. COLOMBIA, San Antonio (*Palmer*), 1 ♂ type. *Exp.* 28 mm.

(1 v) *Jocara albimedialis*, sp. n.

♂. Head and thorax ochreous tinged with rufous; antennæ with the shaft fuscous, the process bright red; pectus and legs ochreous, the fore legs suffused with red-brown; abdomen ochreous dorsally suffused with red-brown and with black subdorsal points

on medial segments. Fore wing whitish suffused with purplish red and irrorated with fuscous; an oblique whitish subbasal striga from below costa to submedian fold; a rather obliquely incurved blackish medial line with broad diffused white band on its outer side; postmedial line blackish, slightly excurved below costa, then obliquely incurved, some deeper red beyond it towards costa; a terminal series of black striæ; cilia purplish red with slight dark lines near base and tips. Hind wing whitish suffused with reddish brown; a black terminal line interrupted at the veins; cilia pale red, white at base and tips; the underside paler except the terminal area, the costal area irrorated with brown, a black discoidal point.

Hab. PERU, La Oroya (*Ockenden*), 2 ♂ type. *Exp.* 18 mm.

(1 x) *Jocara parallelalis*, sp. n.

♀. Head, thorax, and abdomen ochreous suffused with rufous; tarsi with slight palerings. Fore wing ochreous suffused with rufous; antemedial line whitish; oblique, from discal fold in end of cell to inner margin, defined on inner side by raised black scales in cell and submedian interspace; an oblique blackish line from origin of vein 2 to inner margin; a slight black discoidal lunule; a white patch irrorated with black scales beyond upper angle of cell and an oblique whitish line irrorated with black scales from just beyond lower angle to inner margin, with blackish streaks beyond it below veins 6 and 4 to the white postmedial line, which is excurved between veins 6 and 4 to near termen, then oblique; a bright rufous patch on apical part of costa; a fine black terminal line from below apex to vein 3; cilia with a yellowish-white line at base, the tips chequered fuscous and white. Hind wing whitish suffused with brown, especially towards termen; traces of a pale subterminal line excurved at middle; cilia with a yellowish-white line at base, chequered fuscous and white at tips; the underside with the costa slightly irrorated with blackish, a black spot at upper angle of cell, postmedial line blackish strongly excurved, from just below costa to vein 2, defined on outer side by whitish below vein 6, the apex suffused with red, a fine black terminal line forming dentate marks towards apex.

Hab. PERU, Chanchamayo, 1 ♀ type. *Exp.* 26 mm.

(3 a) *Jocara noloides*, sp. n.

♀. Head and thorax whitish tinged with rufous, the vertex of head whiter; antennæ fuscous; palpi with the 3rd joint blackish; tarsi blackish ringed with white; abdomen white tinged with red-brown, a black line at base of anal segment. Fore wing whitish tinged with rufous especially on basal and terminal areas; a minute black subbasal streak in submedian fold; a black antemedial shade formed by two diffused lines with a tuft of raised black scales in the cell; a blackish medial line, slightly angled inwards at median nervure and vein 1; a discoidal spot formed by raised black scales; postmedial line blackish slightly defined

on outer side by whitish, strongly excurved from below costa to vein 4; a subterminal reddish-brown shade, becoming blackish at costa; a terminal series of black striæ; cilia with dark line near base and points near tips. Hind wing semihyaline white faintly tinged with brown; the terminal area suffused with fuscous brown, broadly towards costa, narrowing to a point at vein 1; cilia whitish with a brown line near base; the underside with the costal area suffused with fuscous brown, a blackish discoidal striga.

Hab. BAHAMAS, Nassau (*Sir G. Carter*), 2 ♀ type. *Exp.* 18 mm.

(4a) *Jocara rubralis*, sp. n.

♂. Head and thorax deep red; pectus, legs, and abdomen ochreous tinged with rufous; fore legs deep red in front, the tarsi with pale rings. Fore wing deep red suffused over dark brown; an antemedial black point below the cell and striga from vein 1 to inner margin; an indistinct pale sinuous medial line defined at sides by brown; a bar of raised black and ochreous scales in cell towards extremity, a point at lower angle of cell and a point on vein 2 below end of cell; postmedial line whitish towards costa, then indistinct and pale with minute whitish streaks at the veins, excurved below vein 7, then oblique; a terminal series of black striæ; cilia ochreous faintly tinged with rufous. Hind wing white, the costal area and terminal area to vein 2 suffused with brown; minute postmedial brown streaks on veins 5 to 2; a terminal series of black striæ; cilia red at tips towards apex, then with red line to vein 2; the underside with the costal area tinged with red, the apical area suffused with red, a small black spot at upper angle of cell.

Hab. W. COLOMBIA, San Antonio (*Palmer*), 1 ♂ type. *Exp.* 32 mm.

(3) *Spectrotrota erythrolepia*, sp. n.

♀. Head, thorax, and abdomen whitish tinged with red-brown and irrorated with blackish especially towards extremity of abdomen; palpi reddish brown; tarsi dark brown ringed with whitish. Fore wing whitish tinged with red-brown mixed with crimson-red and irrorated with black; antemedial line black, rather inwardly oblique and excurved just below the cell; a black discoidal bar; postmedial line rather diffused, black defined on outer side by white, slightly waved, excurved to vein 3, then incurved; a terminal series of small black spots; cilia white chequered with blackish. Hind wing whitish tinged with red-brown and irrorated with fuscous; a diffused curved slightly waved fuscous postmedial line; a terminal series of small black spots; cilia chequered white and blackish.

Hab. FORMOSA, Arizan (*Wileman*), 1 ♀ type. *Exp.* 22 mm.

Genus ARÆOPASCHIA, nov.

Type, *A. grisealis*.

Palpi upturned, slender, the 2nd joint hardly reaching to vertex

of head, the 3rd rather long and acuminate; maxillary palpi filiform; antennæ of male ciliated, with a process from basal joint not extending behind the head. Fore wing narrow; vein 3 from angle of cell; 4, 5 approximated for some distance; 6 from upper angle; 7, 8, 9 stalked; 10, 11 from cell. Hind wing with veins 3 and 5 from angle of cell, 4 absent; 6, 7 from upper angle; 8 not anastomosing with 7.

Aræopaschia grisealis, sp. n.

♂. Head and thorax white mixed with reddish brown; abdomen white suffused with reddish brown; antennæ blackish except towards base, the processes blackish fringed with white hair; palpi white irrorated with dark brown, the 2nd joint dark brown in front towards extremity. Fore wing grey-white tinged with brown and sparsely irrorated with black-brown; a blackish spot in base of cell; a curved antemedial series of small black-brown spots from costa to submedian fold; a small discoidal boss of raised metallic black scales and another in submedian fold below end of cell; a subterminal series of slight black-brown spots from costa to submedian fold, incurved to vein 5; a terminal series of minute black spots. Hind wing semihyaline white, the termen tinged with brown to submedian fold and with a brown terminal line and line through the cilia to vein 1.

Hab. BRAZIL, Amazons, R. Ucayala, 1 ♂ type. *Exp.* 26 mm.

(2 a) *Macalla mediobarbalis*, sp. n.

Fore wing of male with very large fringe of hair in middle of cell above, and fringe below apical part of costa.

♂. Head and thorax dark brown mixed with olive greyish; the basal joint of antennæ behind and a tuft behind antennæ white; pectus and legs grey mixed with brown, the fore femora with black patch above, the fore and mid tibiæ with blackish bands, the tarsi blackish ringed with white; abdomen greyish olive mixed with dark brown and with dorsal series of black bars. Fore wing dark brown with a cupreous gloss, the basal area with more or less greyish olive; an indistinct dark antemedial line. Hind wing dark brown with a cupreous gloss, the cilia greyish with a dark line near base; the underside greyer except the apical area and with slight dark discoidal bar.

Hab. SIKHIM (Möller), 2 ♂ type; BORNEO, Sarawak (Wallace), 1 ♂. *Exp.* 24–30 mm.

(2 b) *Macalla flavicollaris*, sp. n.

♂. Head and thorax dark brown mixed with some greyish; basal joint of antennæ white behind; a tuft of hair behind antennæ and the tegulæ yellow tinged with red; pectus and legs yellowish tinged with rufous, the tibiæ with some brown, the tarsi brown ringed with whitish; metathorax edged with yellowish white;

abdomen yellowish tinged with red, the basal half with some dark brown mixed, the basal segment with ridge of yellowish-white scales followed by a series of blackish bars. Fore wing dark brown with a cupreous gloss, the basal area olive-ochreous with some red mixed and with subbasal patches of brown scales below the cell and on inner margin; antemedial line slight, blackish, somewhat angled outwards below costa, then sinuous; postmedial line indistinct, dark, oblique from costa to vein 4, then incurved; a fine ochreous terminal line with a series of small dark spots before it in the interspaces. Hind wing dark brown with a cupreous gloss; cilia with a fine whitish line at base; the underside greyish except the area beyond the cell.

Hab. DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♂ type. *Exp.* 24 mm.

(7 a) *Macalla sordidalis*, sp. n.

Head and thorax fuscous brown mixed with olive-green; antennæ blackish, the shaft ringed with whitish above; pectus and legs grey mixed with brown, the tarsi dark brown ringed with whitish; abdomen olive-green mixed with brown, a dorsal series of black bars except at base. Fore wing olive-green mixed with dark brown and black; a subbasal black spot below the cell; antemedial line black, slightly excurved below costa, angled inwards on median nervure, then oblique; a tuft of raised black scales in cell towards extremity and black discoidal bar; postmedial line blackish, rather diffused and waved, oblique to vein 4, then inwardly oblique; a fine ochreous terminal line with series of small black spots before it in the interspaces; cilia intersected with black at the veins. Hind wing greyish brown, the veins and termen darker; cilia with a fine ochreous line at base followed by a blackish line; the underside with indistinct diffused curved postmedial line.

Hab. SIKHIM (*Möller*), 1 ♂, 7 ♀ type. *Exp.* 24–26 mm.

(8 b) *Macalla mesaleucalis*, sp. n.

♂. Head and thorax bright red-brown mixed with some ochreous white; tarsi ringed with white; abdomen whitish, tinged with rufous at base, extremity, and on ventral surface. Fore wing with the basal and terminal areas cupreous red-brown, the medial area white irrorated with olive-yellow scales; a waved black antemedial line from cell to inner margin; a black discoidal spot; postmedial line black, rather diffused and slightly waved, excurved between veins 6 and 3, then retracted to below end of cell and rather oblique to inner margin, some black irroration beyond it and a diffused subterminal patch from below costa to vein 5; a terminal series of small black spots and a series on the cilia. Hind wing with the costal half of basal area white, the inner half pale brown, the terminal area suffused with fuscous with a cupreous gloss and narrowing to tornus; the underside with the basal half

white with some dark irroration on costa, a small black discoidal spot.

Hab. PROVINCE WELLESLEY (*Ridley*), 1 ♂ type. *Exp.* 32 mm.

(11 c) *Macalla rubripalpis*, sp. n.

♂. Head rufous with some metallic black and white scales on the antennal processes and vertex of head; antennæ black-brown; tegulæ rufous with some white scales; thorax white with some rufous scales and some black-brown on dorsum; abdomen rufous, the base and extremity white; pectus and legs white mixed with some rufous, the tarsi banded brown and white. Fore wing white, the basal area irrorated with rufous, the inner medial area and the terminal area with dark brown, the costal area rufous to end of cell; two rather diffused blackish antemedial lines from the costal area to inner margin; a dark discoidal point; postmedial line dark brown, dentate, oblique to vein 3, then incurved; an indistinct, diffused, rather maculate, dark subterminal line; a terminal series of small dark spots; cilia chequered brown and white. Hind wing white, the apical area tinged with brown; a brown terminal line. Underside white, the costal and terminal areas of fore wing suffused with brown.

Hab. DUTCH N. GUINEA, Mt. Goliath (*Meek*), 1 ♂ type. *Exp.* 32 mm.

(11 i) *Macalla albirufalis*, sp. n.

♀. Head white mixed with rufous, the antennæ rufous, the palpi with rufous ring near extremity of 2nd joint and the base of 3rd joint rufous; tegulæ olive-rufous; thorax white mixed with olive-rufous, the patagia with olive-rufous patches at base and near extremity; abdomen white suffused with bright rufous towards base, then irrorated with rufous; legs banded white and rufous, the hind tibiæ with dark bands at middle and near extremities. Fore wing olive-rufous; a white point in the cell near base; an antemedial white band with slightly waved edges, oblique to median nervure; the inner medial area with some dark scales; an irregular white patch at middle of costa with traces of a line formed by white scales from it to inner margin; a white bar at middle of cell and band of white and blackish scales from cell to inner margin; a white discoidal spot with some blackish beyond it, some above it on costa and a narrow dentate white band from lower angle of cell to inner margin closely followed by a narrow dentate white postmedial band; the postmedial area with an oblique white mark between veins 5 and 3; a subterminal series of white spots defined on each side by blackish scales, angled outwards to near termen at veins 4, 3; cilia chequered white and rufous. Hind wing white, faintly tinged with brown, the costal area and terminal area except towards tornus suffused with brown; cilia white tinged with rufous and with an interrupted brown line at middle. Underside of fore wing grey-brown, the costa rufous

to beyond middle; hind wing white, the costal area irrorated with brown and rufous, the terminal area suffused with brown to submedian fold, a brown postmedial line oblique towards costa, then curved and ending at submedian fold.

Hab. DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♀, Snow Mts., Oetakwa R. (*Meek*), 1 ♀ type. *Exp.* 40 mm.

(11 k) *Macalla argenteorubra*, sp. n.

♂. Head and thorax fiery red, the back of head with tufts of silvery-white scales, the patagia with patch of silvery-white scales at middle and silvery-white tips; abdomen creamy white with some rufous suffusion on dorsum; pectus creamy white and red; tibiae and tarsi ringed with white; ventral surface of abdomen creamy white tinged with red. Fore wing fiery red irrorated with blackish; an antemedial series of slight silvery-white spots with a larger spot further from base above inner margin; a medial silvery-white line from costa to median nervure, angled outwards below costa, and a spot on inner margin, followed by an oblique series of obscure blackish marks, with some silvery-white scales on their outer edge from above median nervure to vein 1; a diffused silvery-white discoidal spot and an incurved series from lower angle of cell to inner margin; a waved silvery-white postmedial line from costa to vein 5, then a series of spots incurved below vein 3; the postmedial area with small spots above and below vein 4; a subterminal series of silvery-white spots defined on each side by black; cilia chequered white and fiery red with some black scales at middle. Hind wing white, the costal area tinged with brown; a terminal series of brown striae; cilia chequered with red and brown spots at base and intersected with red to vein 2. Underside of fore wing pale brown, the costal area and terminal area except towards tornus bright rufous, small ante- and postmedial whitish spots on costa; hind wing creamy white, the costal area irrorated with fulvous and brown scales, a slight fulvous spot at upper angle of cell and diffused postmedial and subterminal bars from costa to vein 5.

Hab. DUTCH N. GUINEA, Mt. Goliath (*Meek*), 1 ♂ type. *Exp.* 42 mm.

(11 l) *Macalla chlorographalis*, sp. n.

♂. Head and thorax pale yellow-green mixed with cupreous red, the tips of antennal processes and patagia bright cupreous red; tibiae with cupreous-red patches, the tarsi blackish with pale rings; abdomen pale greenish suffused with red-brown, the ventral surface ochreous. Fore wing golden green; the basal area almost entirely suffused with deep red; an oblique white antemedial line, defined on outer side by red below the cell; medial area suffused with red to just below vein 2, leaving green streaks on the veins; a small white spot defined on each side by black in middle of cell; slight blackish streaks in the interspaces below end of cell; postmedial

line white defined on inner side by small black spots in the interspaces, slightly excurved from below costa to submedian fold and again above inner margin, some blackish beyond it on costa; the terminal area suffused with red; the subterminal line golden-green, oblique and rather diffused, emitting dentate marks on the veins to termen, where they become white with black bars between them in the interspaces; cilia red, paler at tips. Hind wing red-brown, the cilia red with a pale line at base; the underside brownish white, the costal area irrorated with brown, the terminal area suffused with brown, a small dark discoidal spot, and curved postmedial line.

Hab. DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♂ type. *Exp.* 30 mm.

(11 n) *Macalla nyctizonalis*, sp. n.

♂. Head and thorax ochreous tinged with rufous and irrorated with a few black scales, the metathorax with blackish patch; tarsi brown with slight pale rings; abdomen ochreous suffused with rufous. Fore wing ochreous, slightly tinged with rufous and irrorated with black; a slight subbasal black point below the cell; a broad diffused black antemedial band, followed from submedian fold to inner margin by the black antemedial line, which is also represented by a black point on costa; a small black discoidal spot and spot above it on costa; a blackish shade beyond the cell, incurved below vein 4; postmedial line slight, dark, with black spot at costa, excurved between veins 6 and 4, then incurved and slightly waved, a wedge-shaped blackish patch beyond it from costa to vein 5; a terminal series of black points and a series on the cilia. Hind wing ochreous white slightly tinged with brown; traces of a curved postmedial line; the underside tinged with rufous and with blackish discoidal point.

Hab. PHILIPPINES, Manila (*Ledyard*), 1 ♂ type. *Exp.* 28 mm.

(12 b) *Macalla nyctichroalis*, sp. n.

♀. Head and thorax black, the vertex of head, basal joint of antennæ behind, medial part of tegulæ, tips of patagia, and greater part of vertex of thorax white; palpi at base and extremities of 2nd and 3rd joints white; pectus black and white; legs black banded with white; abdomen white irrorated with black, the terminal segments dorsally black irrorated with white. Fore wing leaden fuscous and black; a small white patch at base; a silvery-white antemedial patch narrowing towards costa and vein 1, where it is confluent with some diffused white on medial part of inner margin, some black before and beyond the white patch; medial white points on costa and below the cell; a black discoidal bar; a broad, slightly curved postmedial silvery-white band, narrowing to costa and to a spot on inner margin, slightly connected with the lower extremity of a spot beyond it on costa, below which there is a black patch; a terminal white band from below apex to tornus,

ill-defined on inner side and with series of small black spots on termen; cilia white with slight fuscous points towards apex. Hind wing whitish, broadly suffused with fuscous on costal and terminal area; cilia whitish with diffused fuscous line, wholly fuscous at apex; the underside with slight sinuous postmedial line.

Hab. BR. NEW GUINEA, Sogeri, 1 ♀ type. *Exp.* 28 mm.

(13c) *Macalla euryleuca*, sp. n.

♂. Head and thorax fuscous black mixed with some grey, the palpi and antennal processes except towards tips, the tegulae and base of patagia cupreous red; abdomen fuscous black with some cupreous red on dorsum and a white band at base; pectus, legs, and ventral surface of abdomen white mixed with fuscous black and some cupreous red, the tarsi black ringed with white. Fore wing with the basal area fuscous black with some cupreous red before the antemedial black bars from costa and inner margin and a tuft of raised black scales in submedian fold rather nearer the base; the medial area white with a slight rufous tinge; a black discoidal bar with tuft of long black and white scales at its lower extremity; postmedial line black, rather diffused, oblique to vein 4, then slightly incurved and somewhat dentate; the terminal area cupreous red with a terminal series of deeper red bars separated by whitish on the extremities of the veins; cilia chequered black and white at tips. Hind wing semihyaline white, the terminal area black with a slight cupreous gloss, narrowing to tornus and with slightly sinuous inner edge. Underside with the basal area of fore wing and base of costal area of hind wing fuscous, the terminal area of both wings black, the medial costal area of hind wing white irrorated with some black scales.

Hab. PERU, San Gaban, 1 ♂ type. *Exp.* 38 mm.

(14c) *Macalla olivaris*, sp. n.

Head, thorax, and abdomen olive-green slightly mixed with brown; antennae blackish; tarsi blackish ringed with white. Fore wing pale olive-green, the terminal area suffused with black-brown; a minute subbasal black streak below the cell and bar on inner area; a small tuft of raised black scales in middle of cell and another on discocellulars; postmedial line black, rather diffused and somewhat dentate, oblique to vein 4, then incurved; a terminal series of black points. Hind wing pale olive-green, the costal area semihyaline whitish, the terminal area suffused with black-brown except towards tornus; an oblique dark discoidal bar and indistinct curved postmedial line; the underside whiter, the terminal area blacker, the costal area irrorated with blackish, the discoidal bar and postmedial line distinct, the latter ending at submedian fold.

Hab. GOLD COAST, Bibianaha (*Spurrell*), 1 ♂, 1 ♀ type, Kumasi (*Sanders*), 1 ♀. *Exp.* 22-24 mm.

(15 b) *Macalla atricinctalis*, sp. n.

♂. Head and thorax olive-brown, some whitish on dorsum of thorax; tarsi blackish ringed with white; abdomen white irrorated with black-brown and with a black band at base of dorsum, the extremity ochreous. Fore wing olive-brown, the basal and terminal areas irrorated with blackish; antemedial line black defined on outer side by white, somewhat dentate and angled inwards below median nervure; tufts of black scales in middle of cell and on discocellulars, the former defined, except above, and the latter on outer side by white; postmedial line blackish with a white mark on its outer side at costa, somewhat dentate, oblique to vein 4, then inwardly oblique to submedian fold and erect to inner margin; a terminal series of small blackish spots; the cilia chequered with blackish. Hind wing reddish brown, the termen darker, the costal area and cilia paler; the underside paler, the costal area with dark irroration, the terminal area suffused with fuscous brown to vein 2, a small dark discoidal spot and waved postmedial line from costa to submedian fold.

Hab. TRAVANCORE, Pirmád (*Imray*), 1 ♂ type. *Exp.* 38 mm.

(16 d) *Macalla plumbeofusa*, sp. n.

♀. Head and tegulæ pale red-brown with slight dark irroration; thorax leaden grey irrorated with dark brown; abdomen whitish tinged with red-brown and irrorated with darker red-brown; antennæ brown; palpi whitish suffused with red-brown; fore legs dark red-brown, the tarsi ringed with white; pectus, mid and hind legs white irrorated with blackish, the mid femora, except at base, and tibiæ suffused with blackish. Fore wing whitish suffused with red-brown and glossed with leaden grey, the basal half more fuscous; traces of a sinuous brown antemedial line; some diffused rufous on discocellulars; traces of a dentate brown postmedial line, slightly angled outwards below vein 7 and inwards below end of cell; a diffused brown subterminal patch on costal area with a faint, slightly dentate pale subterminal line arising from it, slightly defined on each side by brown; a terminal series of black points; cilia tinged with rufous. Hind wing pale grey-brown, the costal area with a silvery gloss; a dark terminal line; cilia whitish with a brown line near base. Underside pale grey-brown, the fore wing and costal area of hind wing with a leaden gloss.

Hab. ROOK I. (*Meek*), 2 ♀ type. *Exp.* 38 mm.

(21 g) *Macalla phæoperalis*, sp. n.

♀. Head, thorax, and abdomen pale olive-brown mixed with grey and blackish; antennæ ringed with black; palpi blackish; pectus and legs suffused with black, the tarsi black ringed with white. Fore wing pale olive-brown mixed with grey and irrorated with black, the terminal area suffused with brown; a rather diffused sinuous black antemedial line; a black discoidal bar;

postmedial line rather diffused, black, incurved below vein 5 and excurved above inner margin; a terminal series of black striæ. Hind wing grey suffused with fuscous brown; a fine white line at base of cilia; the underside whitish irrorated with blackish, the terminal area suffused with fuscous; an indistinct curved postmedial line.

Hab. CEYLON, Galgama (*Mackwood*), 1 ♀ type. *Exp.* 16 mm.

(21.j) *Macalla ochroalis*, sp. n.

♀. Head and thorax ochreous tinged with red-brown and irrorated with a few black scales; antennæ blackish; abdomen ochreous irrorated with black. Fore wing ochreous tinged with red-brown and sparsely irrorated with blackish, the terminal area suffused with red-brown and thickly irrorated with black; the costa with series of black points; a sinuous blackish antemedial line; a black point at upper angle of cell; postmedial line rather diffused, blackish, sinuous, arising below the costa; a terminal series of black points; cilia fuscous. Hind wing greyish suffused with fuscous; a fine dark terminal line and pale line at base of cilia followed by a dark line; the underside whitish irrorated with brown, an indistinct curved postmedial line.

Hab. CEYLON, Eppawela (*Green*), 1 ♀ type. *Exp.* 20 mm.

(22 a) *Macalla metaxanthalis*, sp. n.

♂. Head and thorax golden rufous mixed with some white; pectus and abdomen fulvous yellow. Fore wing golden rufous irrorated with black and white, especially on medial area; an antemedial white patch below the cell and spot above inner margin; a diffused waved white postmedial line; a subterminal series of slight white and blackish marks in the interspaces, displaced towards termen between veins 5 and 3, and with white spot before it below vein 4; cilia chequered with white. Hind wing golden yellow. Underside of fore wing golden yellow.

Hab. DUTCH N. GUINEA, Fak-fak (*Pratt*), 3 ♂ type. *Exp.* 34-42 mm.

(24 a) *Macalla rugosalis*, sp. n.

♀. Head and thorax red-brown, roughly scaled; abdomen pale red-brown; the femora with black-brown bands, the tarsi black-brown, the tibiæ at extremities and tarsi ringed with white. Fore wing red-brown mixed with whitish and irrorated with dark brown; a diffused red-brown antemedial patch from costa to median nervure, and a ridge of raised dark scales from cell to inner margin; some raised dark brown scales on discocellulars and a large patch below end of cell; red-brown marks on costa at middle and just beyond end of cell; a double curved postmedial series of minute dark brown spots with a red-brown shade beyond them; a terminal series of dark brown spots; cilia rufous with a series of small dark

brown spots at base. Hind wing pale greyish brown with a leaden gloss, the costal and terminal areas greyer brown; cilia rufous with slight dark spots at base from apex to submedian fold. Underside grey-brown with a leaden gloss, the inner areas whitish.

Hab. ROOK I. (*Meek*), 5 ♀ type. *Exp.* 40 mm.

(24 b) *Macalla umbrosalis*, sp. n.

♂. Head and thorax ochreous mixed with black-brown and red-brown; abdomen ochreous irrorated with dark brown and dorsally tinged with rufous at base, the genital tufts black. Fore wing ochreous mixed with rufous and irrorated with black, especially on medial and apical areas; rather diffused subbasal black marks below the cell and above inner margin; traces of a wavy black antemedial line; small black spots in middle of cell and on discocellulars; postmedial line blackish, minutely dentate, oblique to vein 4 and strongly incurved below vein 3, defined on outer side by ochreous to vein 3, on which an ochreous streak is emitted to termen; a terminal series of small blackish spots. Hind wing grey suffused with reddish brown; the underside grey irrorated with brown, the apical area suffused with brown.

Hab. BR. N. GUINEA, Mt. Kebea (*Pratt*), 1 ♂ type. *Exp.* 30 mm.

(24 c) *Macalla plumbeopictalis*, sp. n.

♀. Head and thorax white mixed with reddish ochreous; palpi with blackish bars at sides towards tips; antennæ finely ringed white and black; tegulæ and patagia fuscous black at tips; tibiæ banded with black, the tarsi black ringed with white; abdomen white, dorsally suffused with rufous except at base, the sides suffused with blackish, the ventral surface with small paired black spots on 3rd to 5th segments. Fore wing white; the antemedial area leaden grey irrorated with black; a triangular leaden-grey and black patch from middle of costa to median nervure with a tuft of black scales on it in the cell, then a diffused sinuous line to inner margin; a discoidal bar of raised black scales; small post-medial black spots on costa and below vein 6, the area beyond lower angle of cell tinged with olive-brown and the inner post-medial area suffused with rufous; the terminal area black with a leaden gloss, an olive-brown tinge before it towards costa; a rather diffused bluish-white line before termen with minute white streaks beyond it on the veins; cilia white, tinged with brown except at apex and with small black spots at the extremities of the veins. Hind wing white, the terminal area suffused with fuscous black, narrowing to tornus; an oblique blackish subterminal striga at vein 2 and a striga above tornus; the underside with the costal area suffused with black, an indistinct sinuous brownish postmedial line defined on outer side by white at costa.

Hab. DUTCH N. GUINEA, Fak-fak (*Pratt*), 2 ♀ type. *Exp.* 32-36 mm.

(26 a) *Macalla phæobasalis*, sp. n.

♂. Head and tegulæ ochreous tinged with rufous; palpi at tips and antennæ blackish; patagia and thorax brown and fuscous; pectus and legs whitish and brown, the tarsi black ringed with white; abdomen white irrorated with brown and fuscous, and with blackish subdorsal bars on medial segments. Fore wing with the basal area brown suffused with blackish, its outer edge oblique and somewhat dentate; the rest of wing white irrorated with black and suffused with rufous on medial area and above tornus, the apical area suffused with rufous and fuscous; small wedge-shaped black spots at angles of cell; postmedial line very strong, black and oblique from costa to vein 5, then slight, strongly incurved to submedian fold and produced to slight streaks on the veins, then again excurved; a terminal series of blackish striæ; cilia pale rufous with a series of small blackish spots. Hind wing semi-hyaline white; the terminal area suffused with fuscous, narrowing to a point at vein 2, and with slight dark streaks at the veins; cilia white with series of small black spots on apical half.

♀. Thorax ochreous tinged with rufous; fore wing with the basal area suffused with rufous to the oblique black antemedial line.

Hab. CUBA, Santiago (*Schaus*), 5 ♂, 3 ♀ type. *Exp.* 30 mm.

(30 a) *Macalla albifurcalis*, sp. n.

Hind wing of male with fold and tuft of long hair on inner area above.

♂. Head and tegulæ olive-rufous, the palpi white and black, the antennæ finely ringed white and black, the tegulæ black at tips; thorax white, the tips of patagia olive-rufous; pectus and legs white and rufous, the tibiae with blackish patches, the tarsi black ringed with white; abdomen white, tinged with rufous except towards base of dorsum. Fore wing with the basal area olive-rufous with a white patch at base of costa, bounded from cell to inner margin by the rather diffused black antemedial line which is strongly bent outwards below the submedian fold and with some black irroration before it; the medial area white with an olive-rufous patch on middle of costa, a tuft of raised black scales in middle of cell and a small discoidal spot; postmedial line blackish, olive-rufous at costa, rather diffused and waved, excurved between veins 5 and 3, then incurved; the terminal area olive-rufous with some fuscous suffusion at apex; some white beyond the postmedial line at costa and at middle of termen; a terminal series of small blackish spots. Hind wing white, the terminal area suffused with brown, the tuft on inner area rufous; traces of a curved brownish postmedial line with minute dark spots at veins 2 and 1; a rather punctiform dark terminal line; the underside with the costal area tinged with ochreous and irrorated with brown at middle, the postmedial line more distinct.

♀. Abdomen with diffused subdorsal black patches except towards base; fore wing with the black lines and diffused apical patch much stronger; hind wing with the terminal area strongly suffused with fuscous brown.

Hab. TRAVANCORE, Pirmád (*R. L. & Mrs. Imray*), 2 ♂, 4 ♀ type; PENANG (*Flower*), 1 ♀. *Exp.* 28-32 mm.

(30 b) *Macalla hupehensis*, sp. n.

♂. Head and tegulæ white tinged with rufous; thorax white, the patagia at base and dorsum irrorated with fuscous; abdomen creamy white irrorated with black except the basal segment, the anal tuft pale rufous; palpi, pectus, legs, and ventral surface of abdomen pale rufous, the palpi with black ring near extremity of 2nd joint, the tarsi dark brown ringed with white. Fore wing white irrorated with black to the postmedial line, the terminal area suffused with black-brown; a black point in the cell near base and subbasal spot on costa; a rather diffused black antemedial line from cell to inner margin; black spots in middle of cell and on discocellulars, the former with a patch above it on costa; postmedial line rather diffused, blackish, interrupted between veins 5 and 3, a white mark on its outer side at costa; a terminal series of small blackish spots; cilia with a white line at base. Hind wing whitish suffused with brown, the termen darker; a white line at base of cilia. Underside white suffused with brown; fore wing with a patch beyond the cell and the area below the cell to the postmedial line white, the postmedial line indistinct and entire; hind wing with small dark discoidal spot and indistinct diffused postmedial line.

Hab. C. CHINA, Hupeh Prov., Lui-shin-Tze (*Betton*), 1 ♂ type. *Exp.* 22 mm.

(33 a) *Macalla viridirufalis*, sp. n.

Fore wing of male on underside with fringe of large scales in the cell.

♂. Head and thorax creamy white tinged with green and mixed with rufous, the patagia with oblique fuscous streaks; palpi, frons, pectus, and legs creamy white; abdomen creamy white, dorsally suffused with rufous and fuscous. Fore wing olive-green mixed with creamy white, the medial area below the cell and subterminal area below costa suffused with pinkish red and irrorated with dark brown scales; a black spot below the cell before middle; antemedial line almost medial, blackish defined on inner side by white, oblique towards costa, then erect and sinuous; a black discoidal spot; postmedial line formed by dark brown marks in the interspaces, defined on outer side by a narrow white band, oblique from costa to vein 4 where it is angled outwards, then incurved; a narrow diffused white band before termen with white streaks beyond it on the veins; cilia creamy white with series of small dark spots near base. Hind wing pale reddish brown, the terminal

area rather darker; cilia whitish with a brown line near base; the underside paler except the terminal area, a black discoidal point, and rather diffused sinuous brown postmedial line.

Hab. DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♂ type. *Exp.* 26 mm.

(2 a) *Locastra atriplagalis*, sp. n.

♀. Head and thorax white tinged with rufous; palpi red-brown and dark brown, the 2nd joint white behind towards tips; antennæ red-brown; shoulders and outer edge of patagia with red-brown stripes irrorated with blackish; legs brown and black, the tarsi ringed with white; abdomen white tinged with rufous. Fore wing white tinged with rufous; the antemedial area with a large black patch from costa to submedian fold, with a tuft of black hair on its lower edge, some pale golden green below its outer part, its outer edge defined by white; a small discoidal tuft of red scales with a blackish mark above it on costa; a curved blackish medial line from submedian fold to inner margin, where there is a blackish striga before it; some pink suffusion beyond the cell and on inner medial area; a small red and blackish postmedial patch on costa; a diffused red and blackish postmedial line, obliquely incurved below vein 6, the area beyond it pale golden green, becoming whitish towards termen; an indistinct dentate white subterminal line from vein 6 to inner margin, defined at sides by slight red and blackish marks; a terminal series of minute blackish spots; cilia ochreous with a punctiform dark line at middle and dark line near tips. Hind wing white, the terminal area broadly tinged with pink to vein 2; a fine red terminal line and line through the cilia. Underside of fore wing purplish pink, the costa and apical area suffused with brown; hind wing with the costal area and terminal area to vein 2 purplish pink, a slight red postmedial line from costa to vein 2.

Hab. DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♀ type. *Exp.* 40 mm.

(7 c) *Stericta carniola*, sp. n.

Head, thorax, and abdomen rufous irrorated with a few black scales, the antennal processes tipped with fiery red; palpi with the 3rd joint blackish at base and tips; fore legs suffused with dark brown. Fore wing pale flesh-red, the basal area suffused with red-brown, the terminal area red-brown with fine white streaks on the veins, the streaks of hair white and blackish; traces of an oblique brown line from middle of costa to inner margin before middle; a faint slightly curved brown line just beyond the cell; a faint brown postmedial line defined on outer side by whitish; a fine white line at base of cilia. Hind wing pale flesh-red, the terminal area tinged with red-brown except towards tornus with fine white streaks on the veins, the streak of hair in discal fold black and the streak in submedian fold black and white; a rufous medial shade and slight red-brown postmedial line; a fine white line at base of

cilia. Underside ochreous tinged with flesh-colour, the terminal areas suffused with red-brown.

Hab. BR. N. GUINEA, Dinawa (*Pratt*), 2 ♂, 1 ♀ type. *Exp.* 26 mm.

(12*b*) *Stericta trichasema*, sp. n.

♀. Head, thorax, and abdomen pale rufous, the vertex of head with minute black spot, the thorax irrorated with some blackish scales and the abdomen more strongly irrorated with black; palpi black at base and tips; fore tibiæ and the fore and mid tarsi blackish, the tarsi ringed with white. Fore wing rufous mixed with some whitish and irrorated with black, the streaks of hair black and white; a slight black spot below base of cell and a narrow subbasal band formed by black scales; a rather oblique medial line formed by black scales; postmedial line slight, blackish, dentate, defined on outer side by white between veins 5 and 2, a small black spot beyond it above vein 6; a terminal series of small black spots. Hind wing rufous mixed with some whitish and irrorated with black; a blackish bar from lower angle of cell to submedian fold; postmedial line blackish, oblique to vein 4, then dentate, an oblique blackish shade beyond it from costa to discal fold; a terminal series of small black spots except towards tornus. Underside whitish suffused with rufous; fore wing with diffused dark postmedial line, excurved and dentate below discal fold, the terminal area suffused with dark brown except towards tornus; hind wing with postmedial line oblique and blackish to vein 5, then reddish and slightly waved; a black terminal line from below apex to vein 3.

Hab. CEYLON, Kitulgala (*Mackwood*), 1 ♀ type. *Exp.* 32 mm.

(14*a*) *Stericta melanochlora*, sp. n.

♀. Head and tegulæ whitish tinged with red-brown; thorax black-brown; abdomen pale rufous, the sides and ventral surface suffused with black; palpi irrorated with blackish; fore legs blackish, the pectus and mid and hind legs rufous, the tarsi blackish ringed with white. Fore wing black-brown, the medial area with pale grey-green mixed, the terminal area pale grey-green, the streaks of hair-like scales black; a faint sinuous whitish antemedial line; a white discoidal bar with tuft of black scales before it; a slight waved postmedial line formed by white scales, excurved at middle and with a series of small black spots formed by hair-like scales beyond it. Hind wing black-brown, the terminal area pale grey-green, the streak of hair-like scales below the cell black and the one beyond the cell black and white; a slight curved, waved, postmedial line formed by white scales with a series of small dentate black spots beyond it formed by hair-like scales. Underside pale green suffused with black-brown to just beyond the distinct dentate white postmedial line.

Hab. SINGAPORE (*Ridley, Wood-Jones*), 2 ♀ type. *Exp.* 26 mm.

(18 a) *Stericta mediovialis*, sp. n.

♂. Head and thorax sap-green mixed with whitish; abdomen whitish tinged with rufous; legs banded with black-brown. Fore wing sap-green mixed with some rufous, the terminal area whitish; small tufts of black scales below the cell at base and before middle; a diffused dentate whitish subbasal line from costa to vein 1; a medial white band with rather sinuous edges traversed from discal fold to inner margin by a slight greenish and rufous line; a discoidal tuft of blackish scales; an oblique dark shade beyond the cell from vein 6 to above vein 1; postmedial line whitish, diffused at costa, then curved and dentate; a terminal series of black points; cilia red-brown, white at base and tips. Hind wing glossy red-brown with a dark terminal line; cilia rufous with a whitish line at base and whitish tips. Underside rufous; fore wing with fuscous suffusion in and beyond the cell; hind wing with dark discoidal point.

Hab. QUEENSLAND, Cairns (*Meek*), 1 ♂ type. *Exp.* 30 mm.

(19 g) *Stericta phanerostola*, sp. n.

♂. Head, thorax, and abdomen grey-white tinged with rufous; antennæ and palpi rufous; legs suffused with rufous and banded with blackish. Fore wing glossy grey-white tinged with rufous, the terminal area with a browner tinge; the costa blackish towards base with a subbasal white point on it; a patch of blackish scales below the cell near base; a slight antemedial shade formed by blackish scales with a slight curved line beyond it from cell to inner margin, and a white spot at costa defined on outer side by black; a rather diffused blackish postmedial line defined on outer side by white, excurved to submedian fold where it is somewhat angled inwards; a terminal series of blackish points. Hind wing glossy grey-white tinged with purplish; a terminal series of blackish points. Underside white tinged with rufous; both wings with indistinct curved brown postmedial line.

Hab. BR. N. GUINEA, Babooni (*Pratt*), 1 ♂ type. *Exp.* 32 mm.

(19 m) *Stericta igneasalis*, sp. n.

Antennæ of male with short process; hind wing with the inner margin fringed with long hair.

♂. Head and thorax pale ochreous, the sides of tegulæ and the patagia fiery red; palpi at sides, the tibiæ and tarsi tinged with rufous; abdomen ochreous suffused with fiery red, the ventral surface whitish except at extremity. Fore wing with the basal area fiery red, its outer edge oblique and defined by white, some white at base of costa and some brown irroration on inner margin; the rest of wing pale fawn-colour; a slight blackish discoidal spot and dark mark above it on costa; some dark irroration beyond lower angle of cell; a whitish subterminal line defined on each side by slight dark marks except towards costa, where it is pure

white, slightly incurved below costa, then minutely waved and excurved at middle; an apical fiery-red patch and some slight red suffusion towards tornus. Hind wing white, the fringe of hair on inner margin fiery red. Underside of fore wing tinged with red; hind wing with the costal area irrorated with red.

Hab. DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♂ type. *Exp.* 36 mm.

(21 b) *Stericta maroniensis*, sp. n.

♂. Head and tegulæ whitish tinged with rufous; thorax and abdomen red-brown mixed with ochreous whitish; palpi with black point on 1st joint and spot in front of 2nd; pectus, legs, and ventral surface of abdomen ochreous suffused with rufous, the fore legs and tarsi banded with black. Fore wing ochreous suffused with rufous, the basal half extending on inner area to tornus, and the apical part of terminal area thickly irrorated with fuscous and black; a slight black subbasal line from costa to vein 1; antemedial line ochreous, slightly sinuous; a black medial line, oblique to submedian fold, then double filled in with whitish and incurved; postmedial line black, sinuous and approximated to the medial line to submedian fold, then excurved; subterminal line indistinct and pale reddish, oblique to discal fold, then minutely dentate to vein 2, then double, blackish filled in with whitish and angled inwards at submedian fold; a terminal series of black striæ; cilia with some blackish at tips towards apex. Hind wing semihyaline whitish with a faint rufous tinge, the costal area, veins towards termen, and the termen suffused with red-brown; cilia white with a reddish-brown line through them, brown except at base towards apex. Underside of fore wing red-brown, the inner area whitish; hind wing whitish, the costal area tinged with rufous, the apical area suffused with red-brown, a brown discoidal spot and curved rather punctiform postmedial line.

Hab. FR. GUINEA, St. Laurent Maroni, 1 ♂ type. *Exp.* 29 mm.

(8 a) *Orthaga hemileuca*, sp. n.

♀. Head and tegulæ white tinged with rufous; shoulders deep rufous with some black scales; thorax white tinged with rufous and irrorated with some black scales; abdomen pale rufous irrorated with black; antennæ with slight dark rings; palpi irrorated with blackish, a blackish spot in front of 2nd joint and ring near its extremity; legs banded with blackish, the tarsi black ringed with whitish. Fore wing with the basal area whitish suffused with olive-brown and irrorated with blackish, the base and costa with bright rufous mixed; medial area creamy white; the terminal area pale grey suffused with olive-brown especially towards costa; antemedial tufts of raised black scales in submedian fold and below vein 1; a small medial brown spot on costa and fiery red and brown spot at inner margin; a small tuft of white and black

scales on discocellulars with some fiery-red scales beyond it; post-medial line blackish, diffused, slightly dentate, excurved to vein 3, then incurved, the white extending to just beyond it at costa; a terminal series of small black-brown spots; cilia creamy white with a series of small brown spots. Hind wing whitish suffused with red-brown, the cilia creamy white with a red-brown line through them. Underside of fore wing whitish suffused with brown; hind wing creamy white, the terminal area tinged with brown, a black discoidal point, some fiery-red irroration with a few black scales mixed through upper part of cell to the curved blackish postmedial line.

Hab. DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♀ type. *Exp.* 36 mm.

(9c) *Orthaga eumictalis*, sp. n.

♀. Head, thorax, and abdomen whitish suffused with red-brown, the two latter irrorated with dark brown; antennæ dark brown with pale rings towards base; palpi whitish suffused with rufous; tarsi black-brown ringed with white. Fore wing creamy white mixed with red-brown and dark brown; antemedial line white, rather inwardly oblique and straight, with a slight black spot on its outer side at costa; an ill-defined whitish and rufous discoidal spot and diffused black-brown marks beyond and below lower angle of cell; postmedial line white defined on inner side by slight black spots in the interspaces, oblique to vein 5, excurved to vein 3, then incurved; the terminal area more strongly suffused with brown and with a patch of white suffusion at middle; a terminal series of small black-brown spots; cilia chequered creamy white and brown with a red-brown line near base. Hind wing whitish suffused with glossy reddish brown; a dark terminal line; cilia creamy white with a brown line near base and the tips chequered with brown. Underside of fore wing reddish brown, the inner area whitish; hind wing brownish white, the costal area irrorated with rufous and dark brown, the terminal area dark reddish brown, a curved brown postmedial line.

Hab. DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♀ type; BR. N. GUINEA, Mt. Kebea (*Pratt*), 1 ♀. *Exp.* 34 mm.

(9e) *Orthaga hæmarphoralis*, sp. n.

♂. Head and tegulæ blood-red with a brownish tinge; antennæ brown ringed with whitish towards base; thorax white mixed with rufous and red-brown; abdomen rufous; palpi, pectus, and legs bright rufous, the tarsi ringed with white. Fore wing with the basal half white irrorated with red-brown and black-brown, extending on costa to just beyond the postmedial line, the outer part of medial area blood-red except at costa, the terminal area rufous with a greyish tinge; a rather oblique and slightly sinuous black medial line defined on each side by white; postmedial line rather indistinct, red-brown, slightly dentate except towards costa, excurved from

below costa to submedian fold; a terminal series of blackish points; cilia pale red with a series of dark points at base. Hind wing pale rufous with a terminal series of dark striæ, the cilia bright rufous with a fine whitish line at base. Underside of fore wing reddish brown, the inner area whitish; hind wing ochreous white, the terminal area suffused with red-brown, the costal area irrorated with fiery red, a faint curved postmedial line.

Hab. DUTCH N. GUINEA, SNOW Mts., Oetakwa R. (*Meek*), 1 ♂, Setakwa R. (*Meek*), 1 ♂ type. *Exp.* 32-34 mm.

(9*f*) *Orthaga leucophota*, sp. n.

♂. Head and thorax whitish tinged with rufous, the tips of antennal processes and metathorax with some deep rufous and blackish scales, the frons and a tuft of scales between antennæ black; palpi irrorated with blackish, and with a black ring near extremity of 2nd joint; abdomen white tinged with rufous and irrorated with brown; legs banded with blackish, the tarsi black ringed with white. Fore wing rufous; an elongate rather irregular black patch defined by white on antemedial part of costa extending to just below the cell, where there is a ridge of raised rufous and white scales below it above a rather irregular black patch above inner margin before the waved white antemedial line with a small black spot beyond it on costa; small tufts of white scales on the discocellulars and below end of cell; postmedial line white with a small black spot before it at costa, oblique to vein 6, then slightly waved, excurved to vein 4, then incurved and with some black before and beyond it at submedian fold, a conical black-brown patch beyond it from costa to vein 5, extending to apex; a terminal series of small black spots; the cilia black at apex. Hind wing ochreous tinged with brown; a dark terminal line; cilia rufous with a whitish line at base and some fuscous towards apex. Underside of fore wing rufous suffused with brown, the inner area whitish, the apical area darker, the postmedial line brown, curved and slightly waved; hind wing ochreous tinged with brown, the costal area rufous irrorated with brown, the apical area suffused with brown, a curved slightly waved brown postmedial line defined on outer side by whitish.

Hab. DUTCH N. GUINEA, SNOW Mts., Oetakwa R. (*Meek*), 2 ♂ type. *Exp.* 32 mm.

(10*e*) *Orthaga ecphoceana*, sp. n.

♂. Head and thorax rufous; abdomen greyish tinged with rufous; palpi and legs greyish mixed with rufous and dark brown, the tarsi black-brown ringed with whitish. Fore wing with the base and costal area rufous irrorated with brown, the rest of wing to end of cell white irrorated with dark brown, the postmedial area except towards costa velvety black-brown with incurved inner edge, the terminal area red-brown with a slight greyish tinge; a slight interrupted brown line from discal fold

before end of cell to inner margin towards which it is distinct and blackish; postmedial line very faint, pale, defining the outer edge of the dark area, excurved to vein 4, then incurved; a terminal series of slight dark brown spots; cilia whitish mixed with brown and with a brown line near base. Hind wing whitish suffused with glossy reddish brown; cilia with a fine whitish line at base followed by a brown line. Underside of fore wing brown, the costa rufous, the inner area whitish; hind wing brownish white, the costal area suffused with rufous and irrorated with brown, an indistinct curved slightly waved brown postmedial line from vein 4 to inner margin.

Hab. BR. N. GUINEA, Mt. Kebea (*Pratt*), 1 ♂ type. *Exp.* 28 mm.

(10*f*) *Orthaga lithochroa*, sp. n.

♀. Head, thorax, and abdomen brownish grey slightly irrorated with red and dark brown; antennæ fuscous brown; palpi and legs irrorated with black, the tarsi blackish with pale rings. Fore wing pale brownish grey irrorated with rufous and dark brown, the apical area suffused with red-brown and dark brown; the costa black to middle and with a black spot above end of cell; an antemedial tuft of scales below the cell; an oblique blackish shade from the postmedial line at vein 5 to submedian fold below end of cell; postmedial line dark brown, slightly waved, oblique to vein 5 and incurved below vein 3; a terminal series of slight dark points. Hind wing whitish tinged with brown; a darker terminal line; cilia whitish with a brown line through them. Underside whitish; fore wing suffused with brown except the inner area; hind wing with the costal area irrorated with brown, the apical area suffused with brown, a curved slightly waved brown postmedial line.

Hab. N. AUSTRALIA, Port Darwin (*Dodd*), 1 ♀ type. *Exp.* 24 mm.

(2) *Xenophasma chalcoclora*, sp. n.

Proboscis fully developed; antennæ of male with slight tufts of scales at the joints; fore wings with veins 4, 5 stalked; hind wing with vein 4 absent; 6, 7 from upper angle of cell.

♂. Head and thorax pale golden green, the vertex of head and basal joint of antennæ rufous, the shaft of antennæ ringed with blackish; abdomen whitish tinged with brown; legs banded blackish and white. Fore wing golden green; a white spot defined by blackish in base of cell, some blackish above it on costa; antemedial line black defined on inner side by white, rather diffused on outer side, curved and slightly waved; black spots defined by white in the cell towards extremity and on discocellulars; postmedial line black defined on outer side by white, rather diffused on inner side, incurved to discal fold, then excurved and slightly angled outwards at veins 5, 4, 3, then incurved and slightly angled at vein 2; some black striæ on costa towards apex; a terminal

series of black bars defined on inner side by white. Hind wing whitish tinged with brown; a slight dark discoidal point and post-medial line excurved at middle; a dark terminal line. Underside of fore wing pale olive-green, the costa with some black scales on it to the postmedial line, a slight blackish discoidal spot, post-medial line black towards costa, then indistinct, angled outward at vein 4; hind wing whitish tinged with brown especially on terminal area, a slight black spot on upper discocellular, post-medial line blackish defined on outer side by whitish, excurved at middle.

Hab. COLOMBIA, Minca (H. H. Smith), 1 ♂ type. *Exp.* 20 mm.

Genus *TINEOPASCHIA*, nov.

Type, *T. minuta*.

Proboscis fully developed; palpi porrect, extending about one and a half times length of head and rather thickly scaled to near extremity; maxillary palpi nearly as long as the labial palpi and thickly scaled; frons smooth; antennæ of male ciliated and thickened by ridges of scales above; tibiæ smoothly scaled. Fore wing narrow, the apex rounded, the termen obliquely curved; veins 3, 4, 5 from angle of cell; 6 from below upper angle; 7, 8, 9 stalked; 10, 11 from cell. Hind wing with vein 3 from angle of cell; 4, 5 stalked; 6, 7 coincident; 8 strongly anastomosing with 7.

Tineopaschia minuta, sp. n.

♂. Head blackish, the antennæ ringed black and whitish; palpi black; thorax and abdomen whitish mixed with blackish. Fore wing whitish tinged with brown and slightly irrorated with blackish, the costal edge black towards base; a black patch on costa just before middle with an oblique slightly sinuous line from it to inner margin; a blackish discoidal bar. Hind wing whitish tinged with brown and slightly irrorated with fuscous. Underside of fore wing whitish suffused with brown; hind wing white, the costal and terminal areas tinged with brown and irrorated with some dark scales.

Hab. JAMAICA, Moneague (Walsingham), 1 ♂ type. *Exp.* 10 mm.

(2) *Stenopaschia gallerialis*, sp. n.

♂. Head and thorax red-brown mixed with whitish; abdomen white slightly tinged with red-brown. Fore wing red-brown mixed with whitish and slightly irrorated with black, the costa tinged with olive-green; the antemedial part of costa blackish; a rather inwardly oblique sinuous blackish medial line; a small discoidal tuft of raised scales; an inwardly oblique minutely waved dark brown postmedial line with a red-brown subterminal shade rather closely approximated to it; some blackish on apical

part of costa and a terminal series of blackish points. Hind wing whitish tinged with brown. Underside of fore wing fuscous brown with an oblique blackish postmedial striga from costa defined on each side by white; hind wing white, the costal area tinged with brown.

Hab. COLOMBIA, Minca (*H. H. Smith*), 1 ♂ type. *Exp.* 16 mm.

(2) *Rhynchopaschia virescens*, sp. n.

♀. Head and thorax pale grey-green with a few fuscous scales, the tips of patagia blackish; abdomen pale brownish grey irrorated with fuscous; antennæ fuscous brown; sides of frons with black spots; palpi suffused with black; legs suffused with black, the tarsi black ringed with white. Fore wing with the costal half pale green irrorated with white to the postmedial line, the rest of wing whitish suffused with red-brown and irrorated with black except on terminal area; a black point below base of cell; an ante-medial boss of metallic-black scales on inner margin; a tuft of long metallic-black scales in middle of cell and a tuft of black and white hairs at upper angle of cell; postmedial line indistinct, brown defined on outer side by white, oblique to discal fold, incurved and strongly dentate below vein 4, a black spot beyond it on costa; a terminal series of slight blackish spots. Hind wing whitish suffused with brown, the cilia with a fine white line at base. Underside whitish strongly suffused with dark reddish brown; hind wing with dark discoidal spot and diffused postmedial line angled outwards beyond the cell.

Hab. GOLD COAST, Bibianaha (*Spurrell*), 1 ♀ type. *Exp.* 24 mm.

Genus PROROPOCA, nov.

Type, *P. rubrescens*.

Proboscis fully developed; palpi downcurved, extending about twice the length of head and thickly scaled; maxillary palpi strongly dilated with scales; antennæ of male laminate and ciliated; vertex of head clothed with rough hair. Fore wing narrow, the apex rounded, the termen obliquely curved; veins 3, 4, 5 radiating from angle of cell; 6 from upper angle; 7, 8, 9, 10 stalked; 11 from cell. Hind wing with veins 3 and 5 from angle of cell; 4 absent; 6, 7 from upper angle; 8 anastomosing with 7.

Proropoca rubrescens, sp. n.

♂. Head, thorax, and abdomen ochreous mixed with red-brown, the last with small dorsal deep red-brown spots on 2nd to 4th segments. Fore wing ochreous suffused with red-brown and slightly irrorated with dark brown, the terminal area with a greyish tinge; some dark brown on costa near base and a subbasal tuft of dark brown scales in the cell; a tuft of dark brown scales in

middle of cell and a rather diffused line defined on inner side by ochreous white from cell to inner margin; a dark brown discoidal bar of raised scales; an obliquely incurved dark red-brown shade from apical part of costa to inner margin before the postmedial line, which is white, slightly waved, excurved from below costa to vein 3, then strongly incurved; a terminal series of dark brown bars. Hind wing whitish suffused with brown, the terminal area darker except towards tornus. Underside of fore wing glossy red-brown; hind wing whitish suffused with glossy red-brown, a brown spot on upper discocellular.

Hab. COLOMBIA, San Antonio (*Palmer*), 1 ♂ type. *Exp.* 22 mm.

Genus AUSTROPASCHIA, nov.

Type, *A. porrigens*.

Proboscis fully developed; palpi obliquely porrect, extending about three times the length of head and strongly fringed with hair above and below; maxillary palpi strongly dilated with hair; antennæ of female ciliated. Fore wing rather long and narrow, the apex rounded, the termen evenly curved; vein 3 from well before angle of cell; 4, 5 radiating from angle; 6 from upper angle; 7, 8, 9 stalked; 10, 11 from cell; a fan of scales just below middle of cell. Hind wing with vein 3 from well before angle of cell; 4, 5 radiating from angle; 6, 7 from upper angle; 8 free.

Austropaschia porrigens, sp. n.

♀. Head and thorax white mixed with brown; palpi blackish at extremities; tarsi dark brown ringed with whitish; abdomen ochreous white slightly irrorated with dark brown. Fore wing grey-white irrorated with dark brown, the inner area with a red-brown tinge; the fan of scales below middle of cell black-brown at tip; a waved dark brown medial line; an oblique black discoidal bar of raised scales; an oblique dark brown shade from vein 6 beyond the cell to below end of cell; postmedial line black-brown, dentate, oblique from costa to vein 5, then inwardly oblique and incurved below vein 2 to below end of cell; some black-brown suffusion at apex and a terminal series of black-brown striæ; cilia with a fine white line at base. Hind wing whitish suffused with brown, the terminal area darker except towards tornus; cilia with a brown line near base. Underside of fore wing brown mixed with some whitish, a postmedial whitish patch on costal area and a waved brown postmedial line from costa to vein 4; hind wing white tinged with brown, the postmedial area whiter from costa to vein 5, the terminal area browner except towards tornus, a slight brown discoidal spot and faint postmedial line from costa to vein 2.

Hab. W. AUSTRALIA, Yallingup (*R. E. Turner*), 3 ♀ type. *Exp.* 36-40 mm.

Genus POLIOPASCHIA, nov.

Type, *P. brachypalpia*.

Proboscis fully developed; palpi obliquely porrect, extending about twice the length of head, the 2nd joint fringed with hair above and below, produced to a point below at extremity, the 3rd moderate and thickly scaled; maxillary palpi strongly dilated with hair; antennæ of female ciliated. Fore wing with the apex rounded, the termen evenly curved; vein 3 from before angle of cell; 4, 5 from angle and somewhat approximated for a short distance; 6 from upper angle; 7, 8, 9 stalked; 10, 11 from cell; a fan of scales below middle of cell and another on the discocellulars. Hind wing with vein 3 from before angle of cell; 4, 5 from angle and somewhat approximated for a short distance; 6, 7 from upper angle; 8 anastomosing with 7 at a point.

Poliopaschia brachypalpia, sp. n.

♀. Head and thorax white mixed with brown; tibiae and tarsi with blackish bands; abdomen ochreous irrorated with dark brown, the ventral surface white. Fore wing white tinged in parts with red-brown and irrorated with black, the antemedial, postmedial, and subterminal parts of costa more thickly irrorated; tufts of scales at middle and end of cell and fan of scales below middle of cell; a waved black medial line; short black streaks beyond the cell on veins 4 to 2; postmedial line black, oblique to vein 5, then dentate and incurved below vein 3, with slight black streaks beyond it on veins 7 to 4 and on vein 2; a terminal series of blackish points; cilia with a series of small brown spots near base and brown line near tips. Hind wing white slightly tinged with brown, the terminal area suffused with brown; an indistinct slightly waved brown postmedial line from costa to vein 2, excurved below vein 5; cilia white with a series of small dark brown spots at middle except towards tornus. Underside of fore wing white suffused with brown except on inner area, an indistinct brown postmedial line excurved at middle; hind wing white, the costal area irrorated with brown, the veins beyond lower angle of cell tinged with brown, the terminal area suffused with brown except towards tornus, a brown discoidal point, the postmedial line more distinct and extending to submedian fold.

Hab. W. AUSTRALIA, Yallingup (*R. E. Turner*), 1 ♀ type. *Exp.* 34 mm.

CHRYSAUGINÆ.

(3a) *Gephyra lamprosalis*, sp. n.

Hind wing with veins 3 and 5 from angle of cell, 4 absent.

♂. Head and thorax glossy red-brown; abdomen grey tinged with red-brown; pectus, legs, and ventral surface of abdomen grey tinged with red-brown. Fore wing glossy red-brown; a slight yellow mark on the costal excision towards apex; a fine white

terminal line from apex to vein 4; cilia yellowish white at tips except towards tornus. Hind wing grey tinged with reddish brown. Underside grey tinged with brown; fore wing with the hair below the costal lobe whitish, a slight oblique yellowish striga from costa beyond middle and spot at the excision towards apex.

Hab. PERU, Cuzco Mts. (*Garlepp*), 2 ♂ type. *Exp.* 12 mm.

(2) *Neophrida meterythralis*, sp. n.

Head, thorax, and abdomen fiery crimson with a slight ochreous tinge; legs pale red-brown, the tarsi white ringed with red-brown; pectus and ventral surface of abdomen white. Fore wing fiery crimson with numerous faint oblique lines formed by striæ with a slight silvery gloss; an indistinct very oblique brown line from costa before middle to inner margin beyond middle, a minute yellowish spot in end of cell and red discoidal spot; a patch of whitish suffusion on costal area before the oblique slightly curved brown line from costa beyond middle to inner margin near tornus; the termen and cilia orange-yellow except at apex and tornus, its inner edge slightly sinuous. Hind wing fiery crimson; the cilia rather paler, the hair on inner margin white. Underside of fore wing deep crimson, the costal and inner areas irrorated with whitish to near termen; hind wing silvery white tinged with crimson especially below the cell and on inner area, the termen crimson, a crimson discoidal spot and curved postmedial line from costa to submedian fold.

Hab. COSTA RICA (*Schaus*), in U.S. Nat. Mus.; VENEZUELA, Esteban Valley, Las Quignas, 1 ♂, 1 ♀ type. *Exp.*, ♂ 42, ♀ 52 mm.

(2 a) *Salabrena flavisectalis*, sp. n.

♀. Head and base of tegulæ brownish white, the tips of tegulæ purplish red, the thorax brown and purplish red; antennæ dark brown; palpi pale red, the 3rd joint whitish above; fore legs pale red; mid and hind legs dark brown and whitish; abdomen reddish brown with whitish rings on two basal segments, the ventral surface purplish red except towards extremity. Fore wing purplish red slightly irrorated with fuscous, the medial area strongly irrorated except towards costa; a slightly curved grey antemedial line defined on each side by brown; an oblique sinuous yellowish-white striga from middle of costa; a small oblique wedge-shaped yellow mark from costa beyond middle and a black line from vein 6, excurved beyond the cell, then sinuous and double; cilia with blackish line at middle, the tips white below apex and above tornus. Hind wing glossy reddish brown, the cilia white at tips except towards apex and tornus. Underside of fore wing grey-brown, the costal area and terminal area except towards tornus broadly rufous, an oblique yellowish-white striga from middle of costa with two blackish lines arising from its lower extremity, a faint curved blackish subterminal line; hind wing fuscous brown to just beyond the waved white postmedial line, the costal area

with purplish red mixed, the terminal area purplish red, a slightly waved blackish subterminal line, cilia blackish with series of white points at base and the tips white except at apex and tornus.

Hab. COLOMBIA, Choko Prov., Condoto (*Spurrell*), 2 ♀ type. *Exp.* 20 mm.

(4a) *Idnea phœnicocraspis*, sp. n.

♀. Head and thorax rufous mixed with greyish; abdomen greyish tinged with rufous; fore and mid legs tinged with purplish red, the tarsi whitish towards extremities. Fore wing grey-white suffused with rufous and slightly irrorated with dark brown, the costa purplish red at base and with oblique purplish-red shade from costa before middle to beyond upper angle of cell, the postmedial part of costa white; the terminal area and cilia purplish crimson with a white shade before them; traces of a whitish postmedial line forming strong dentitions on the veins from below costa to vein 2. Hind wing reddish brown with a greyish gloss, the cilia purplish crimson except towards tornus. Underside reddish brown with a greyish gloss; fore wing with the basal half of costal area tinged with purplish red, the terminal half of costa white.

Hab. PERU, Yahuarmayo, 1 ♀ type. *Exp.* 36 mm.

(1a) *Azamora olivescens*, sp. n.

Hind tibiæ of male without tuft of hair from base; fore wing on underside with large patch of black-brown androconia on medial area from subcostal nervure to vein 1.

♂. Head, thorax, and abdomen ochreous slightly tinged with rufous. Fore wing ochreous tinged with olive-green; the base of costal area and a broad band before the antemedial line with a rufous tinge; a fine curved brown antemedial line slightly defined on outer side by whitish; the medial part of inner area slightly tinged with rufous; a slight brownish discoidal spot; postmedial line brown faintly defined on outer side by whitish, oblique to vein 5, then incurved; a faint curved brown subterminal line bent outwards to tornus; the apical part of costal area tinged with rufous; cilia with a dark brown line at base and dark brown tips. Hind wing whitish tinged with brown, the postmedial area suffused with black-brown androconia except just below vein 2 and at inner margin; cilia with a dark brown line at base. Underside whitish tinged with brownish ochreous; fore wing with a large patch of black-brown androconia from subcostal nervure to vein 1.

Hab. VENEZUELA, Esteban Valley, Las Quignas, 1 ♂ type. *Exp.* 30 mm.

(4) *Hypocosmia chrysopyra*, sp. n.

♂. Head and thorax glossy red-brown with a crimson tinge; antennæ darker brown; tibiæ and 1st joint of tarsi fringed with crimson-red hair below, the tufts of scales on 1st joint of tarsi above black-brown, the rest of tarsi ringed brown and white; ventral surface of abdomen with the anal segment white at

extremity. Fore wing metallic golden yellow, the basal and medial areas suffused with purplish red; the 1st line almost medial, silvery white defined on each side by black-brown, forming a spot from costa to discal fold, then rather inwardly oblique; two black-brown postmedial lines filled in with silvery white towards costa, oblique to vein 6 near termen, then inwardly oblique and more widely separated, traces of a brown subterminal line just beyond it and brown streaks to termen above and below vein 6; a black terminal line; cilia purplish red with a yellowish line at base and silvery-white tips towards apex and tornus. Hind wing golden yellow, the apical area tinged with fiery red; a fiery-red terminal line; cilia with a fine white line at base followed by a purplish-red line, the tips silvery white except towards tornus. Underside golden yellow, the fore wing, except the inner area and the costal area of hind wing, suffused with purplish red; both wings with a dark brown apical patch with a white striga before it from costa, the fore wing with an irregular white patch at apex on the dark patch.

♀. Legs dark brown and white without crimson-red hair below.

Hab. VENEZUELA, Esteban Valley, Las Quignas, 1 ♀; PERU, Yahuarymayo, 1 ♂ type. *Exp.* 22 mm.

(2) *Heterauge albilineata*, sp. n.

Head and thorax reddish brown tinged with grey; abdomen fuscous, the anal tuft whitish; palpi, pectus, fore and mid legs fuscous, the hind legs whitish. Fore wing purplish red-brown tinged with grey; an oblique sinuous white medial line; postmedial line white, slightly excurved at middle; cilia fuscous with a white line at base. Hind wing fuscous brown with a white line at base of cilia. Underside greyish fuscous, the costal area of fore wing tinged with purplish red.

Hab. COLOMBIA, Choko Prov., Condoto (*Spurrell*), 1 ♂, 1 ♀ type. *Exp.* 16 mm.

(1 b) *Xantippa rufiflavalis*, sp. n.

♂. Head and thorax yellow suffused with rufous; abdomen yellowish white slightly tinged with rufous; palpi, fore legs, and the tufts of scales on hind legs crimson-red. Fore wing yellow suffused with rufous; antemedial line yellow, straight, and erect; postmedial line yellow faintly defined on inner side by brown and with a dark brown point at costa, straight and erect; cilia yellow with a crimson line at base. Hind wing yellowish white, the apical area and hair on inner margin tinged with rufous; a fine crimson terminal line and a line through the cilia from apex to vein 3. Underside of fore wing crimson-red, the inner area yellowish white, a deeper red antemedial bar from costa and a yellow postmedial line from costa to vein 2 defined on inner side by deeper red; hind wing yellowish white, the costal area tinged and irrorated with crimson-red, a yellow postmedial line from costa to vein 6.

Hab. COLOMBIA, Choko Prov., Condoto (*Spurrell*), 1 ♂ type.
Exp. 16 mm.

(3 a) *Xantippa purpureofusa*, sp. n.

♀. Head and thorax greyish ochreous suffused with deep purple-red; abdomen whitish suffused with brown; tarsi ringed with white; ventral surface of abdomen yellowish suffused with rufous. Fore wing yellowish tinged and irrorated with deep purple-red, the basal half of costal area strongly suffused with deep purple-red, the terminal area deep purple-red; a purple-red discoidal spot and a spot above it on costa; traces of a postmedial line, sinuous to vein 3, then very oblique to above vein 1 before middle and erect to inner margin; a terminal series of dark brown striae; cilia greyish brown with an obscure dark line at middle. Hind wing whitish suffused with reddish brown especially towards termen; a terminal series of dark brown striae; cilia tinged with purplish red, whitish at base. Underside of fore wing reddish brown, the costal area yellow thickly irrorated with purple-red and with a small yellow spot above end of cell, the inner area whitish to the obscure sinuous yellowish postmedial line; hind wing whitish, the costal area and terminal area to vein 3 yellow thickly irrorated with purple-red, a reddish discoidal striga and postmedial striga from costa to discal fold.

Hab. COLOMBIA, Sierra del Libane (*H. H. Smith*), 1 ♀ type.
Exp. 22 mm.

(1 a) *Parachma ruftinctalis*, sp. n.

♂. Head and thorax dull ochreous tinged with reddish; abdomen greyish tinged with reddish; palpi, pectus, legs, and ventral surface of abdomen dull ochreous suffused with purplish red, the tarsi brownish ringed with whitish. Fore wing dull ochreous tinged with purplish red; a diffused rather inwardly oblique purplish-red medial shade and a postmedial shade somewhat excurved at middle; cilia purplish red, white at tips. Hind wing white tinged with brown; a fine red terminal line except towards tornus. Underside of fore wing pale purplish red, the inner area whitish, a yellowish mark at middle of costa defined on outer side by brown, the postmedial line yellowish with a brown mark before it on costa; hind wing whitish, the costal area and the terminal area to vein 2 yellowish tinged and irrorated with purple-red, a diffused purple-red postmedial line from costa to vein 5.

Hab. ARGENTINA, Goya (*Perrens*), 1 ♂ type. *Exp.* 18 mm.

(1 b) *Parachma phœnicochroa*, sp. n.

♀. Head, thorax, and abdomen purple-red, the last with a slight whitish tinge; the spurs and tarsi of hind legs ringed with whitish. Fore wing uniform purple-red. Hind wing fulvous orange, the costa and cilia purplish red. Underside purplish red irrorated with greyish.

Hab. BRAZIL, Amazons, Pará, 1 ♀ type. *Exp.* 22 mm.

[To be continued.]

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THE ANNALS
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XVIII.—*Notes from the Gatty Marine Laboratory, St. Andrews.*—No. XXXIX. By Prof. M'INTOSH, M.D., LL.D., F.R.S., &c.

[Plate VII.]

1. On the Coloration of *Cæsicirrus neglectus*, Arwidsson.
2. On *Cirratulus (bioculatus) incertus*, M'I.
3. On the British Serpulidæ, with a Note of those procured in the 'Porcupine' Expeditions and those obtained by Canon Norman in Norwegian Waters.
4. On a *Placostegus* from the 'Porcupine' Expedition of 1870.

1. *On the Coloration of Cæsicirrus neglectus, Arwidsson.*

ALL that is known of the coloration of this by no means uncommon species is the remark by Cunningham and Ramage*, in their "Polychæt Fauna of the Firth of Forth," that in their "*Axiothea catenata* the colour is pinkish, pale towards the anterior end, with broad bands surrounding the body at intervals." The region whence these authors drew their supplies has since altered its character, probably from pollution, so that a careful search was unsuccessful. It lives gregariously in tubes of sand-particles sunk in the sand. In the Welsh examples† the anterior end of the annelid is somewhat pale, though the median vessel causes a streak along the dorsum, the blood

* Trans. Roy. Soc. Edinb. vol. xxxiii. pp. 679 &c. (1888).

† I am indebted to Mr. Arnold Watson for the living examples which he sent from Wales.

at the same time tinting the cephalic plate. In front of the third bristle-tuft the anterior region has a smooth and glistening cuticular coat, which is iridescent; and at the segment-junction in front of the tuft (third) a faint reddish belt, apparently from a blood-vessel, occurs. The next segment-junction has a belt of red on each side of it, apparently of reddish pigment, the specks of which pass a short way on the following segment (fifth bristled), which has its bristle-tuft about the middle. Then there is a slight constriction of the body-wall—at which a broad red belt occurs, a bristle-tuft (sixth) being placed just in front of another red belt which passes all round the body. The next bristle-tuft (seventh) is in front of a furrow marking another segment, the anterior third of which has the broadest band of red yet met with in front. This is followed by a pale region ending at the next bristle-tuft (eighth), and concluding the specially differentiated region anteriorly, the seventh to eighth tufts being separated by a long interval. The next segment and half of the following are coloured except at the margins by a longitudinal belt of red, apparently along the intestine, probably from an intestinal sinus, and thereafter the reddish hue is due to the longitudinal and circular vessels, especially those of the gut, the tip of the tail and its cirri being pale. In these examples the majority of the short anal cirri had processes at the tip, as Arwidsson shows in his figure*, and describes as “short, fringe-like lobes,”—some being only bifid, others trifid or quadrifid, whilst each of the processes in a bifid form may have two or more minor papillæ at the tip. Occasionally the cirrus ends in a bluntly conical apex, with a minute papilla at each side near the apex. The gut itself is yellowish or pale orange. The proboscis, which is constantly protruded by the animal when removed from its tube, shows a tinge of red from a blood-vessel along the middle in extrusion, and its distal region appears to be smooth.

2. *On Cirratulus (bioculatus) incertus, M'I.*

In the ‘Monograph of the British Marine Annelids’† ambiguity was caused by the use of the specific name *bioculatus* for a Cirratulid dredged in the Zetlandic seas by Dr. Gwyn Jeffreys, the name *bioculatus* having been applied by Keferstein‡ to another Cirratulid differing

* Proc. Roy. Irish Acad. vol. xxix. no. 6, p. 219.

† Vol. iii. pt. i., text, p. 253.

‡ Zeitschr. f. wiss. Zool. Bd. xii. p. 121, Taf. x. figs. 23-27.

from this in several particulars. The species is small, and it is unknown whether it is a young or an adult form, only a single example having been obtained, and it measures about five-eighths of an inch in spirit, its diameter being about 1 mm. The general aspect is indicated in the sketch (Pl. VII.), though the eyes have now disappeared. The segments are about fifty-five in number. The head shows less of a basal constriction than usual in examples of *Cirratulus cirratus* of the same size. The cirri from the fourth segment are of great length, probably reaching in life beyond the tip of the tail. The latter has a similar termination to that of *C. cirratus*, the ventral papilla being the more prominent. The caudal region thus diverges from Keferstein's *C. bioculatus*, which possesses two well-marked caudal cirri.

The dorsal capillary bristles in front are of considerable length, and shorter forms are continued behind these. Thus at the tenth foot the long slender tuft of finely-tapered capillary bristles with a slight curvature at the tip* occupies the dorsal division, whilst the ventral series consist of bristles having short cylindrical shafts, which expand into knifeblade-like tips finely tapered at the extremity, five being fully developed. About the twentieth foot the dorsal bristles are shorter but retain the same character, and by-and-by hooks appear in this division. In the ventral division they are at first accompanied by a bristle—indeed, occasionally a bristle is found in the dorsal division with the hooks† posteriorly. The hooks thus correspond with those of *Cirratulus*, and differ from Keferstein's species or any allied form with the bifid hooks‡.

I am indebted to Mr. Southern, who has specially worked at the Cirratulids, for drawing my attention to the ambiguity of the title in the Monograph. It had escaped observation. A reference to the figure of the hook in the Monograph will show that it cannot be confounded with Keferstein's species.

3. On the British Serpulidæ.

The earlier investigators of the Serpulids gave a large share of their attention to the calcareous tubes, founding species on the nature of the coils and their texture, or, it may be, on the structure of the opercula and branchiæ.

* 'Monograph,' pl. ciii. fig. 16.

† *Id.* pl. cv. fig. 19.

‡ *Id.* pl. cv. fig. 18.

No modern investigator, however, would feel safe in relying on these distinctions without also subjecting the bristles, hooks, body-wall, and life-history to careful examination. In order to indicate the proportional abundance of the Serpulids in British waters, notes of a few of the collections made by exploring ships and by zoologists at various limited localities are added, as well as extracts from one or two memoirs devoted to the group.

Philippi * (1844) furnished a description of the Mediterranean Serpulids, entering no less than twenty-six, though Grube in the same region had only twelve. Philippi relied much on the structure of the opercula and, in the case of *Portula*, on the spiral arrangement of the branchiæ, or the fan-like nature of the branchiæ in *Psygmorebranchus*. These data are insufficient, and consequently considerable confusion resulted. Thus, for instance, his genus *Vermilia* included six new species, and of the two new forms one was the common *Pomatoceros triqueter* and the other was probably synonymous with the ubiquitous *Serpula vermicularis*, entered, as also was the former, under another genus.

Mörch † (1861-63), in his "Revisio Critica Serpulidarum," has about 125 species of Serpulids under sixteen genera, *Spirorbis* having no less than twenty-seven, *Hydroides* seventeen, *Serpula* fourteen, *Vermilia* twelve, *Protula* and *Placostegus* each eleven, *Ditrypa* eight, and the others smaller numbers. This list could be considerably reduced almost under every genus.

Dr. Johnston ‡ (1865) gives ten in the body of the work, and in the Appendix Dr. Baird adds another and no less than seventeen species of *Spirorbis* from the literature of the subject; but in both cases the number of species needs substantial reduction, since some appear under two or three titles.

De Quatrefages § (1865) mentions about a hundred and nine species as occurring throughout the ocean; but it is evident that many are synonymous, and that the series could be much reduced.

Twenty species are recorded by Malmgren || from the extensive northern waters, ranging from Greenland to the North Sea; but some of these are evidently doubtful, such as the second species of *Filograna* and several species of

* Archiv f. Naturges. Bd. x. p. 186, Taf. vi. figs. A-T.

† Naturhist. Tids. Kjøbenhavn, Bd. i. p. 347.

‡ Cat. Worms Brit. Mus. pp. 264 & 346.

§ Annel. t. ii. pp. 484 &c.

|| Annul. Polych. (sep. copy), p. 119.

Spirorbis, and there is also doubt concerning *Vermilia* and the two species of *Ditrypa* and *Hydroides*.

Claparède* (1868) includes nine Serpulids in his Neapolitan Polychæts, and they are spread over nine genera, of which *Psygmodon* alone has two species.

Grube† (1877) records only two species in the extensive collections of the German ship 'Gazelle,' viz. a *Serpula* and a *Pomatoceros*. In his Philippine Annelids seven Serpulids are entered, six falling under *Serpula* and one under *Ditrypa*.

Levinson‡ (1883) includes twenty species in his Northern Polychæts, nine being Spirorbids, the rest being distributed over nine genera, of which *Protula* and *Ditrypa* had each two.

In the great expedition of the 'Challenger' (1885) through the diverse waters of the world§, twenty-two Serpulids were encountered, the genera most in evidence being *Protula* (four), *Serpula* (five), and *Placostegus* (five), the three thus representing more than half the total number secured. It is interesting that not a single complete *Spirorbis*—only two or three fragments of tubes—was obtained. In all probability, the haunt of the majority of the Spirorbids is the littoral region both of foreign seas and our own.

The expedition of the U.S. Coast Survey Steamer 'Blake' || (1887) in the rich waters of the Gulf of Mexico and the Caribbean Sea produced under the able hands of Ehlers (1887) only eleven species, but spread over nine genera—*Spirobranchus* having three species, the rest but one representative.

Twenty-six species of *Spirorbis* are described by Caullery and Mesnil¶ (1897) in their important memoir on the genus, and collected from various parts of the world.

Ehlers** (1901) has thirteen Serpulids in the collection of Polychæts from the Straits of Magellan and from Chili, of which eight are Spirorbids, the rest spread over four genera.

In the careful account of the Serpulids from the Pacific

* Annél. Chétop. Naples.

† Monat. Königl. Akad. Wiss. Berlin.

‡ Meddel. nat. Forh. Copenhagen, pp. 189 &c.

§ 'Challenger' Reports, vol. xii.

|| "Results of Dredging," &c., Mem. Museum Comp. Zool., Cambridge, U.S.A., vol. xxxi.

¶ Bull. Ac. France et Belgique, t. xxx. p. 185, pls. vii.-x.

** Polychæten Magell. u. Chilen. Strandes.

Coast of N. America by Mrs. Pixell-Goodrich* (1912) eighteen species are recorded, more than half of which are Spirorbids.

The same authoress (1913) describes six in her report on the Serpulids of the Scottish Antarctic Expedition, three being Spirorbids and three other genera having one each.

Mrs. Pixell-Goodrich (1913) enters no less than twenty-five species secured by Prof. Stanley Gardiner in the "Percy Sladen Expedition" to the prolific waters of the Indian Ocean. About half of these are under two genera, viz. *Hydroides* (five) and *Spirobranchus* (eight), two of the other genera having two species and *Spirorbis* three.

Twenty-nine species appear from the wide area included in the 'Campagnes Scientifiques' of the Prince of Monaco by the experienced hand of Prof. Fauvel † (1914). Seven of these are Spirorbids.

In Canon Norman's Norwegian dredgings three species were obtained, viz. *Hydroides norvegica*, *Serpula vermicularis*, and *Ditrypa arietina*. The same forms, with the addition of *Placostegus tridentatus* at 305 fathoms, were procured by the 'Knight Errant.' In the 'Porcupine' Expedition of 1869 *Protula protensa*, *Filograna implexa*, *Hydroides norvegica*, and *Ditrypa arietina* were dredged. The list was slightly extended in the 'Porcupine' Expedition of 1870; for, in addition to *Filograna implexa*, *Hydroides norvegica*, *Serpula vermicularis*, *Placostegus tridentatus*, and *Ditrypa arietina*, a variety of *Placostegus* ‡, if not a new species, was obtained off Cape de Gatte in 45 fathoms, and *Pomatoceros triqueter* from Ras el Amush. The great numbers of *Ditrypa* from Bono Bay, and their comparatively small size, were noteworthy.

The paucity of Serpulids in local faunas is noteworthy. Thus, in the 'Catalogue of the Marine Invertebrates and Fishes of St. Andrews' (1875) seven occur, two being Spirorbids, the others distributed over various genera. The same number is given by Marion and Bobretzky § (1875) at Marseilles, two belonging to the genus *Apomatus*, the others singly to different genera. Leslie and Herdman || (1881), in their "Invertebrate Fauna of the Firth of Forth," enumerate three Serpulids, two of which are Spirorbids.

* Proc. Zool. Soc. 1912, p. 784.

† Fascicule xlv.

‡ *Ibid* p. 15.

§ Ann. Sc. Nat. 6^e sér. t. iii. p. 94.

|| Proc. Roy. Phys. Soc. Edinb. vol. vi. p. 67.

Langerhaus* (1880) enters eleven from Madeira, three of which are Spirorbids. Some of the entries are doubtful. Harvey Gibson† (1886) mentions seven in his "Catalogue of the Vermes of the Liverpool District"; but one of the two Spirorbids is uncertain. Nineteen species are entered by Lo Bianco‡ (1893) in his "Tubicolous Annelids of Naples," and several of these are synonymous. As a result of many years of patient labour at Dinard, France, De St. Joseph met with nine species, all under diverse genera. A single species of *Spirorbis* is entered.

Mr. Southern§ (1914) enters eight species in the "Survey of Clare Island," three of which are Spirorbids.

Six occur in Allen's|| (1915) "Catalogue of the Polychæta of Plymouth and South Devon," three of which are Spirorbids.

The first form is *Protula tubularia*, Montagu, which especially abounds in British waters, both in the south and in the north. When the branchiæ are removed, the anterior aspect of the *cephalic plate* presents in the middle the two somewhat triangular scars for the bases of the branchiæ, each surrounded by a rim, whilst between and beneath them is the central mass connected with the mouth. Dorsally, a fillet trends upward on each side to join the prominent, curved, and acutely-pointed dorsal folds of the collar, which forms a continuous frill on the lateral and ventral edges. The branchiæ are barred with pink and green (*Montagu*), those, however, from Plymouth being tinted only with red.

Whilst a certain agreement exists between the cephalic region of *Protula* and the Sabellidæ, the tenacity with which the branchiæ cling to the basal tissue is characteristic of the Serpulids. In *Protula* the branchiæ form two comparatively short forms, the filaments in each of which range from thirty to sixty. They do not, as a rule, present a spiral arrangement in the preparations, though the tips are often coiled in various ways. Each filament springs from a basal web, which is elongated dorso-ventrally to accommodate the large series of these organs, and distally ends in a free subulate process, considerably longer, for instance, than in *P. intestinum*, in which the short tip

* Zeitschr. f. w. Zool. Bd. xxxiv. p. 118.

† Proc. Lit. Phil. Soc. Liverpool, vol. xl. p. 159.

‡ Atti Acad. Fisiche Mat. Napoli, vol. v. no. 11, pp. 81-93.

§ Proc. R. Irish Acad. vol. xxxi. no. 47, p. 146.

|| Jour. M. B. A. n. s., vol. x. p. 643.

has a slight web on the inner side. The pinnæ are of moderate length and closely arranged in a double row along the inner border, the basal region of each being wider; thereafter it tapers to the blunt tip. None of the camerated chordoid tissue so characteristic of the Sabellid branchiæ is present either in filament or pinna, though it is clear that cellular supporting tissue must be in both. The filaments are best developed toward the dorsal edge of the fans.

Toward the tip of the filament the pinnæ diminish in length, and end in short papillæ at the base of the free distal processes, into which, so far as can be observed, only a blood-vessel enters. When thrown off, the vitality of the branchiæ is considerable.

A bilobed fillet lies between the bases of the branchiæ dorsally, and at its ventral edge is a triangular process. Ventrally is a wide gap leading to the mouth, which has a short fissure in the lower lip.

In the small variety from Herm the subulate process at the tip of the branchial filament and the pinnæ are proportionally shorter, but the structure is the same.

The dorsal lip, ciliated and often bordered with brown, is placed between the first two dorsal branchiæ, and carries two palpi. This is separated from the mouth by the ventral lip, which is colourless.

The *body* in the free example is somewhat broad anteriorly, and tapers from the middle gradually to the tail, which has a terminal anus. It is somewhat flattened both dorsally and ventrally, a median groove occurring dorsally in the anterior region and ventrally in the posterior region. The anterior region, moreover, has the broad membranous web, continuous anteriorly with the dorsal fold of the collar, and which passes laterally above the bristle-tufts, ending ventrally by joining that of the opposite side behind the last bristle-tuft of the region. This membrane is supported by a greatly developed alar or dorsal process of the foot, which tapers distally, and is freely mobile, so that when the annelid withdraws itself into the tube this membrane and the bristles are closely applied to the dorsum. No spine supports the alar process, so that the muscles of the bristles suffice for all its movements, which would appear to be partly respiratory, since its blood-vessels are finely reticulated.

The pore for the thoracic organ is placed on the second setigerous segment in the mid-dorsal line (*De St. Joseph*). The "thorax" is greenish, the alar membrane veined with green, and each segment is distinguished by a band of red.

The first segment has two touches of orange or red (without crystalline elements), whilst the abdomen is reddish or orange.

The first region of the body consists of eight segments as a rule, viz., the peristomial and seven bristled segments. Moreover, as De St. Joseph pointed out, the first and the last have glandular scutes on the ventral surface, the first, in a line with the first bristle-tufts, being especially large. The first setigerous process and its bristles are usually directed differently from those which follow, viz., obliquely upward, forward, and outward, the rest being in repose placed obliquely upward and backward. The bristles are somewhat shorter than those which follow, and present more distinct, though very translucent and narrow wings. The typical anterior bristles are pale golden and highly iridescent long slender bristles with straight shafts and but slight curvature of the finely tapered tips, the wings being so narrow as to be almost indistinguishable, only a linear streak indicating their presence on careful inspection. Such, therefore, differs from the condition in *P. tubularia*, where De St. Joseph describes and figures the wings as not only distinct, but striated. The wings are also more distinct in *P. intestinum* from the Mediterranean. It is possible that friction modifies the wings in this region, and hence the more evident nature of those on the first bristle-bundles, which are less exposed.

The posterior region differs from that in *Protula intestinum*, for instance, since it presents no evident bristles to the naked eye or under a lens, for they are usually so closely adpressed as to escape notice, whereas in *P. intestinum* the posterior region has on each side a palisade of long glistening bristles. Such, however, is apparently due to friction, since in those best preserved similar though smaller bristles occur in this species.

Other tufts show only short shafts dilating gradually toward the distal end, which is curved, flattened, and translucent, the slender tips of which occasionally project beyond the surface.

The small variety dredged off St. Peter Port, and found between tide-marks at Herm, has somewhat better-developed wings to its bristles, and the tips of the posterior bristles are more clearly scimitar-shaped, being curved backward like Symes's knife. In others, the straight tips ended in sharp points, but whether such was due to injury or malformation is not at present clear.

The rows of hooks occur on the ventral side and behind

the bases of the bristle-bundles in the anterior region, and consist of minute, thin, translucent organs, which have a long anterior face ending inferiorly in a slightly curved spine corresponding to the main fang in other forms. The edge appears to be minutely serrated. The outline below the main fang forms a narrow gulf, and then trends to the thin basal plate. The posterior outline dips inward so as to make a prominent and bluntly conical crown, and then joins the basal plate. The great number, transparency, and delicate nature of these hooks are characteristic features. If Wolleboek's figure* of the hook of *Protula arctica*, Hansen, is correct, it differs from the foregoing in general shape, shortness of the main fang, large size, and small number of teeth above it—indeed, there are five times the number in the British form.

The posterior hooks are smaller, but do not structurally differ from the anterior. They are situated on prominent lamellæ along the sides of the body, and toward the tail these are very closely arranged. The very minute serrations on the anterior face of these hooks is in contrast with the condition in *Protula intestinum*, and even with De St. Joseph's figure of *P. tubularia*.

No form in the whole range of the Polychæts is of greater interest than the second species, viz., *Filograna implexa*, Berkeley, the life-history and reproduction of which, its plastic and protean character, as well as the concrete calcareous masses, often of considerable size, formed by its thread-like tubes, combine to surround it with a halo of interest, were it only for the study of variability in a single type. In this form the cephalic region presents a smooth gap between the rounded ends of the lamella forming a border to the anterior division of the body. A little below the edge of the lamella on each side is a flattened process of the collar which expands considerably distally so as to form a conspicuous structure. Ventrally the collar in the preparations folds backward as a broad lamella, split distally into two lobes, which in all probability are directed forward when in the tube. Two eyes occur in the dorsum of the peristomial segment. Each consists of pigmented spherules ("crystallins," *De St. Joseph*), numbering in the one seven and in the other eye ten.

The branchiæ are eight in number, four on each side, and in the spirit-preparations are about half the length of the

* Skrift, svensk. Krist. 2 Bd. no. 18, p. 120, pl. xlviii. figs. 6a & 6b.

body. Each consists of a tapered filament with a somewhat camerated axis, giving a transversely barred aspect due to what De St. Joseph calls mucous cells, which have not the differentiation of the Sabellid axis, and become indistinct in mounted preparations. The long diameter of these cells is about 2500th of an inch, less in their short diameter. A double row of proportionally thick pinnæ is attached to the inner edge, each pinna having a central axis of similar structure to that of the filament, and the tip is bluntly rounded and often curved. The distal pinnæ diminish in length, the last being a mere papilla, and the filament ends in a short smooth process, often slightly clavate in spirit and more opaque than the rest. Moreover, the dorsal filament on each side ends in a thin, flattened, and somewhat ovoid plate, the pair performing the function of an operculum. In fresh examples the pinnæ present a double row of rough granular cells (mucous cells, *De St. Joseph*) set in a hyaline matrix, and in some views these have a spiral arrangement.

In an example a pair of elongated glandular sacs (nephridia?) occurred in front of the sixth bristle-tuft of the anterior region in the cœlom, the tips crossing each other. In structure they were granular. The intestinal canal is dilated behind the anterior region (seventh bristle-tuft), and runs as a straight tube from end to end. No diatoms or radiolarians were found in it, only brownish granules and sand-particles. The colour is translucent orange with the intestine dusky brown. It tints the tube, so that it has a faint reddish hue when the animal is within. The branchiæ are pale.

The first region of the body has seven or eight pairs of bristle-tufts, which, with the peristomial segment, makes a total of eight, the second region has from thirty-five to forty segments. The body is somewhat flattened both dorsally and ventrally, with a median groove in the posterior region on both surfaces, and terminates posteriorly in an anus with a prominent papilla at each side, which, according to De St. Joseph, may assist in the formation of the tube. The anterior region has the alar membrane, which stretches from the collar along each side to the posterior edge of the last segment of the anterior region, where it bends ventrally and joins that of the opposite side, as in *Protula*, leaving a free flap posteriorly. It forms a more uniform margin than in *Protula*, and is, in the preparations, generally directed obliquely upward, the bristle-tufts being

beneath and so closely applied as to appear to be oblique rays supporting it.

The first bristle-tuft is directed outward and forward, and the bristles have translucent straight shafts and a knife-shaped tapered tip. Two or three, again, have broader curved tips with a differentiation or "bite" at the basal edge of the blade, but the serrations on this were not visible under the power used.

The six pairs of bristles which follow slope upward and backward, have similar translucent straight shafts, but the tapered tips are more slender, and about two in each tuft have the curved tips with the differentiation of the base seen in the first bristle-tuft. The indistinctness of the serrations is in bold contrast with the condition of such species as *Salmacina œdificatrix*, of Naples, yet the difference is only one of degree.

The second region of the body seems to be devoid of bristles for a short distance, whilst the posterior part has them in pairs, the tips being long and finely tapered, with distinct wings at the base. De St. Joseph mentions one or two geniculate bristles in the ventral division.

The minute, translucent, anterior hooks have a nearly straight anterior edge, serrated throughout and ending below in a main fang, the outline being continued with a curve below the hook and ending at the basal edge. The crown is minute, and the posterior outline slopes to the base, which appears to have a straight edge. The rounded projection below the main fang, shown by De St. Joseph in *Filograna implexa*, differs from that of the present examples. These hooks are situated slightly behind and to the ventral side of the bristles, and form considerable rows. The posterior hooks are smaller, but agree in structure with the anterior. They are placed on the dorsal side of the bristle-tufts, and are few in number in each row.

The eggs are red and the embryos resemble those of *Salmacina dysteri*.

Early trochophores of a deep red colour occurred in the vessels on the 9th June, the prototroch being visible on each side. They simply rotate or swim in small circles, but the larvæ with commencing segmentation of the body dart through the water with great vigour, and often in a straight line; whilst others made larger circles near the bottom. One of the latter showed three segments behind the head, and in all the two eyes were distinct.

The sperms seem to develop a little later than the ova, none, indeed, appearing in the bud, but by-and-by they fill

the non-bristled region in front of the ovigerous segments and bulge laterally, the region being thus characterised by its pallor.

The masses of tubes formed by this species are often of large size, showing that by rapid budding it can hold its own in the struggle for existence, probably quite as effectively as in the case of those with large ova—these being few. The notion that the character of the tubes as to closeness and divarication may indicate specific distinction is uncertain. Much will depend on freedom from injury in the living or dead condition and the site inhabited.

Not all the examples from St. Andrews have opercula. Some have none, the tips of all the branchiæ (eight) showing only a process enlarged at the tip, the granular cells being arranged in a somewhat regular manner and often hexagonal in outline.

The prominent dorsal edges of the collar of the next species, *Hydroides norvegica*, Gunner, are supported by the first bristle-bundles, a considerable gap, however, occurring in the mid-dorsal line. It then passes ventrally to expand into a large thin lamella sloping on each side to a median notch, so as to be more or less bilobed, and is either reflected backward or stretched forward on the base of the branchiæ.

The branchiæ form two well-marked fans on each side of fifteen to eighteen filaments, the dorsal filament in addition on each side being modified either into a complete or a rudimentary operculum, and it seems to be immaterial which side develops the complete organ, since it is sometimes the one and sometimes the other. The branchial filaments are of moderate length, and taper distally to end in a short subulate process, often concealed when coiled. No special chordoid or other axial structure is present, but the cuticle is very thick. The pinnæ are rather short, devoid of a special stiffening apparatus, and extend to the tip, partially overlapping the terminal process. They taper a little from base to apex.

In life the branchiæ are spotted with crimson, and have a pinkish hue from the colour of the pinnæ.

The pedicle of the operculum has a transparent but tough investment of a cellular membrane (mainly hexagonal). Internally is a yellowish fibro-granular apparently muscular cylinder in the preparations. The distal funnel or disc of the operculum is brownish and horny, and when viewed from above has somewhat the aspect of a Chinese umbrella with

a fissured and spinous rim of sixteen to twenty or more processes. Moreover, the upper surface of the disc is armed with spikes, which form a series of rings round the central area. In lateral view it is vase-shaped, with a graceful inclination outward and upward from the narrow stem. Each of the rays forms a stout tapering process, terminated by a thin flexible tip, each side being armed with three or four stiffer and shorter spines, a double contour being visible for fully the basal half. The longest lateral spines are, as a rule, the distal pair, since they have a wider area to guard. This elegant horny apparatus takes the place of the calcareous operculum of other forms, and the flexible tips of the rays apparently yield to a certain extent in withdrawal into the tube, thus causing the spines to approach each other more closely, and efficiently protecting the aperture. In some large examples the dorsal and lateral spikes are bifid, various smaller spikes occur in the intervals, and an imperfect ray is intercalated between two of the others.

The second tier of the operculum forms a graceful fluted cup with about twenty-seven crenations, each separated from its neighbour by an involution of the tough integument enclosing hypodermic cells and granules. The muscular fibres in the centre of the stem expand as they approach the lower operculum, the centre of which they pull on, and so fix the elastic crenate margin on the sides of the tube. The protection of the aperture is thus doubly secure, for the distal spiny shield closes over the crenate cup and exposes only the tough spiny rays to an aggressor. It requires great force to detach this cup from the opercular stalk, apparently from the toughness of the cuticle. The rudimentary organ of the other dorsal edge is often minute, resembling a *Loxosoma*, and springs from the fan near the base of the first filament of the side.

The dorsal edge of the collar, which is supported by the first bristle-bundles, forms the commencement of the alar membrane, which passes backward over the anterior bristles to their termination, beyond which its thin edge projects ventrally as a flap of a bluntly conical outline. In the preparations, as a rule, the anterior edges of the alar membrane approach each other, whilst the posterior margins, as they trend to the ventral surface, are wide apart. The bristle-tufts stand clear of the membrane on each side, and the free ventral flap is ample. The dorsal surface in this region is somewhat flattened, whilst the ventral is slightly convex and marked by a median groove. In the second

region the dorsum of the body is slightly convex throughout, and the ventral surface is but little flattened and marked by a median groove, which runs to the tapered tail with the bilobed anus at its extremity. There are about seventy segments in the posterior region.

The general colour of the body is reddish orange, the alar membrane anteriorly being paler. The lower tier of the operculum is pinkish in lateral view.

The first setigerous process is separated by a considerable interval from the second, and is directed upward and forward. It has two kinds of pale golden bristles, viz., a series with stout, slightly curved shafts which gently dilate from the base upward to the shoulder, beneath which, in the larger, is a slight convexity posteriorly. The shaft is striated and has a central differentiation or axis which trends distally to the long tapering process with a finely serrated edge. Anteriorly, the shoulder abruptly ends in two short spurs with rounded tips. Three of these bristles toward the upper edge of the tuft are larger and longer than the others and probably have special functions. The second kind of bristle is a slender form with simple, tapering, minutely serrated tip often slightly curved, and they are distributed over the whole breadth of the fascicle, a few shorter forms being visible at the lower edge.

Six pairs of bristle-tufts follow, their direction being obliquely upward and backward. These are simple, rather strong, slightly curved, and tapering bristles with narrow serrated wings, and in ordinary specimens the tips seem to have suffered from friction.

The posterior region of the body has no bristles anteriorly, but toward the tail from nine to eleven pairs of long, slender, tapering, capillary bristles appear, decreasing in length from the first to the last. They are usually in pairs, and are nearly straight, only a trace of a curve being observable in their slender tips, which appear to be minutely serrated. Moreover, at the base of these are four or five brush-shaped forms with a cylindrical shaft and funnel-shaped tip with short spikes.

The anterior rows of hooks are long and pass ventrally from the bristle-bundles. Each hook is somewhat polygonal in outline, the anterior edge having six strong teeth (occasionally only five, in which case they are somewhat larger) above the main fang, whilst below it a narrow gulf and a prominent prow give a character to the hook. The posterior outline forms one of the oblique sides of the polygon, the inferior outline being nearly straight, and slight

striae cross the body of the hook obliquely. The number of hooks in these long rows is great, and the pigment-line indicating them remains after removal of the cuticle and hooks.

The posterior hooks have the posterior outline considerably lengthened, so as to alter the character of the hook and give it a resemblance to that often seen in the Ampharetidæ and Terebellidæ. They have four teeth above the chief fang, which is proportionally larger than in front, and the basal outline is slightly convex. Oblique striae are also present on the body of the hook. The ligament, as in the anterior hooks, is attached to the angle between the posterior outline and the base.

Dorsally the edge of the alar membrane in the fourth form, *Serpula vermicularis*, L., is continuous with the collar on each side—a considerable gap, however, intervening between the points of attachment. The collar then passes on each side as a deep frilled lamella to the mid-ventral line, where it is continuous with that of the opposite side. The mouth opens between the branchiæ nearer the ventral than the dorsal border; dorsally it has the ciliated upper lip, and ventrally the ciliated lower lip, whilst below the latter is a triangular area.

The branchiæ, which are from 30–32 on each side, form two fans of moderate length, and are tinted of a fine red hue near the tip. Each filament diminishes toward the extremity and ends in a long tapering process. The cuticle is thick, and the longitudinal and circular muscles well developed, but no chordoid skeleton is present. The pinnæ are of moderate length, the longest being about a third of the length from the tip, and they taper from base to apex, and likewise show no chordoid skeleton. Their colour is variable, reddish with white bars, entirely red or white, with darker zones; sometimes the base is red and the rest white. The pinnæ take their hue from the bars of colour of the region to which they are fixed. In very young examples the base is red, and the filaments greenish from the blood.

The opercula spring from the dorsal edge of the branchial fans, that on the one side being short and rudimentary, whilst that on the other forms a finely fluted vase supported on a stalk, which gradually expands as it passes upward to the fluted cup, which has from fifty to a hundred or more denticulations (a hundred and six, *De St. Joseph*). In many cases the functional operculum is on the left, in others on the right. The distal cup is hollowed

and comparatively thin, and the divisional striæ run to the centre, cutting off the hypodermic area. Moreover, though the surface of the cup appears smooth to the naked eye, it presents under the microscope numerous minute chitinous papillæ, and, if it has been injured, the cicatrix and various irregularities of the divisions are apparent. Occasionally abnormalities not due to injury are present.

The body is, in the preparations, broad in front and tapered gradually to the tail, which ends in the anus. It is flattened both dorsally and ventrally anteriorly, and, indeed, more or less so throughout, and marked ventrally by a median groove which commences behind a triangular area in front and extends to the posterior end of the body. The anterior region consists of seven bristled segments and the fused peristomial segment, and it is proportionally shorter than in *Hydroides*. The alar membrane is broad dorsally, the sides touching in front and separating posteriorly, whilst the ventral lamella is of moderate breadth. The first pair of pale golden bristles is even more widely separated than in *Hydroides*, forming prominent setigerous processes a little behind the anterior dorsal angle of the alar membrane and collar. The distance between these and the next tuft is nearly as large as between the second and seventh, and the direction is upward and forward. The bristles closely correspond in structure with those of *Hydroides norvegica* and their function is probably similar. Each tuft has a series of strong bristles with long, slightly curved shafts which expand a little anteriorly at the shoulder, though some also present a slight convexity posteriorly in the same region. On the anterior edge of the shoulder are two short conical spurs, whilst the posterior half is extended into a long, tapering, serrated process. As indicated by Fauvel, the region below these spurs is roughened by numerous spikes in young forms. They afterwards completely disappear. Interspersed with these are the long, simple, tapering, curved bristles with minutely serrated edges, as in *Hydroides*. The other bristles of the region spring from shorter setigerous processes, have nearly straight shafts and slightly curved tapering tips with narrow serrated rings.

Bristles are absent from a great part of the posterior region, again reappearing in groups toward the tail. They are very long, extremely slender bristles, tapering to a hair-like point which is finely serrated. They are longest at the commencement of the series and diminish posteriorly, and are accompanied by short brush-shaped forms, one outline

of the funnel-shaped tip being longer than the other. The posterior bristles have a peculiar fungoid growth which forms a blackish coating to the shaft or to the tip.

The anterior hooks are avicular with four teeth above the main fang, which has a well-marked gulf below and a prominent prow, which projects about as far as the point of the chief fang. The crown is comparatively narrow, and the posterior outline is slightly concave, whilst the inferior outline of the base is convex with a slight incurvation posteriorly. The body of the hook is striated.

The posterior hooks are smaller, and have, as a rule, five teeth above the main fang; the prow is less prominent, the inflection of the posterior outline is nearer the base, and the basal outline has a more distinct inflection posteriorly. Striae likewise pass from the teeth down the body of the hook. The number of hooks in each row is large. Fauvel gives a total of six to eight teeth in the posterior hooks.

Tube either fixed or free, of a rosy or greenish colour, and measuring 3 or 4 inches in length, with a smoothly rounded and dilated trumpet-like aperture, various lines of growth, and occasionally with a keel more or less rough. Anteriorly it is straight or with a wide curve, but posteriorly often coiled in a spiral manner. It is attached to shells, masses of *Cellepora*, to rocks, stones, or vases thrown into the sea, and is generally solitary, though masses of the tubes occasionally occur both in the north and west of Scotland. When on the inner surface of the lower (flat) valve of a large oyster, the tubes are nearly parallel. In some the prolongation of the tube takes place from the narrow (inner) edge of the trumpet, and thus four or five prominent rings may be formed anteriorly. Fauvel describes seven longitudinal ridges in the typical form of tube—of which the median dorsal is the most conspicuous.

The dorsal part of the collar in the next species, *Pomatocerus triqueter*, L., forms a great free lamella, which, probably by accident, is sometimes separated from the rest of the collar, and its edges are lacinated, though normally it seems to be smooth. The collar continues to the ventral surface as a broad membrane usually thrown into folds in the preparations. De St. Joseph considers the separate parts of the collar dorsally are normal.

The branchiae are somewhat short, and as usual arranged in two lateral fans of thirteen or fourteen (twenty, *De St. Joseph*) filaments, each of which is tapered from base to apex, where

it is terminated by a subulate process of some length. The pinnæ are short, and slightly tapered from base to apex. A white band of great purity runs round the base of the branchiæ, bordered by a belt of red on each side. The filaments are barred alternately with white and red. Methyated spirit alters the red colour of the branchial plumes to a permanent blue. De St. Joseph found *Trichodina pediculus*, Ehr., on the branchiæ at Dinard.

The single operculum springs from the dorsal edge of the left fan by a somewhat rounded stem, enlarges and flattens out as it proceeds upward, and dilates at the summit into a large flat cushion for the support of the calcareous operculum, which is prettily marked with white—shield-fashion. Just before the last-mentioned dilatation it sends out a process on each side resembling an ear, and occasionally this auricular process is bifid or quadrifid. The calcareous tip assumes various forms—viz., conical, tuberculated, saucer-shaped, bifid, or very often trifid. On removing the calcareous cap, a tough layer is left on the summit of the cushion with projections corresponding to the form of the cap. The cone is not regular, but has its steepest side placed dorsally. After the action of hydrochloric acid, a brownish scale of organic tissue with somewhat regular hexagonal reticulations is left. Internally the opercular pedicle has a strong elastic ligament from the summit to the base surrounded by muscular bundles, chiefly transverse. The thrusting out of the operculum (if such happens) is thus voluntary, the withdrawal and retention more or less involuntary.

The cuticle of the entire opercular apparatus is tough and glistening, faintly marked under the microscope with fine striæ. The colour of the operculum varies, most being pale, the stalk often presenting two specks of brown. Almost every example from Lochmaddy, North Uist, has an operculum with three prongs, the only exception being one here and there with only two prongs, but in all probability a third would by-and-by appear. A variety with a flat operculum from which the three spikes arose was also occasionally met with. The operculum is a favourite site for parasitic growths, such as the chambered Foraminifera, *Vorticella*, and zoophytes.

The body is widest anteriorly, where the alar membrane further increases the breadth, and tapers gradually to the tail, which ends in a somewhat broad tip with a papilla at each side. It is rounded dorsally, slightly flattened and

grooved ventrally. The anterior region consists of six bristled segments* and the fused peristomial segment, thus differing from *Serpula* and *Hydroides* in the absence of the conspicuous first pair of bristles on the dorsal edge of the fused collar and alar membrane. The alar membrane passes backward above the bristles, the sides separating as they go to fuse with each other as a broad thin flap on the ventral surface behind the anterior region. Anteriorly it and the collar are yellowish externally and bluish internally, and the bluish colour appears laterally and posteriorly. The posterior region has sixty to seventy segments. All the bristles are directed upward and backward as pale golden flattened tufts, and the structure is the same throughout this region. Each bristle has a translucent and nearly cylindrical shaft with a slight curvature toward the commencement of the tapering tip, which has two narrow wings so arranged that in certain views the space between them seems to be hollowed out. The dorsum anteriorly is pale brown or purplish brown, whilst the general colour posteriorly is dull yellow with pink lateral regions.

The posterior bristles have slender cylindrical shafts, which diminish and then dilate superiorly as they approach the broad shoulder, the spinous distal edge of which has a concavity trending on one side to a delicately tapered whip. This peculiar tip would seem to combine the functions of the long simple and the brush-shaped bristles of other forms. The anterior bristles have a proportionally short hold of the tissues, a feature of importance in connection with the habits of the annelid, and, whilst they point upward and backward, the posterior are directed transversely or ventrally and slightly forward. In each case the bristles are at the end of the rows of hooks—the anterior at the dorsal end, and the posterior at the ventral end.

The alimentary canal appears to be similar to that of *Sabella*, forming a moniliform duct, wide anteriorly and diminishing posteriorly. It is coated with nucleated cells externally.

The cœlomic corpuscles are large and round.

A yellowish coiled gland (nephridium?) occurs anteriorly, external to the gut and adhering to the body-wall. Its structure is granular.

De St. Joseph found Protozoa apparently referable to *Anoplophyra*, Stein, in the intestine.

* De St. Joseph states that there are seven, but six only occur in Britain.

The anterior hooks have the shape of a triangle, the posterior outline, which is slightly concave, gently curving to the crown and forming the base of the triangle, the sides of which are formed by the anterior outline with its eight teeth and the peculiarly modified main fang, which resembles a blunt probe-like process with a small incurvation beneath, the prow of the hook being minute and trending with a slight curve to the inferior outline, which is nearly straight, and the body of the hook is crossed by oblique striæ. The number of these hooks in each row is great, and in some they are indicated by a dark line with a dark speck at the ventral end.

The posterior hooks are smaller, and have only seven teeth above the modified main fang, but their shape agrees with those of the anterior hooks. Both these and the anterior hooks are situated near the edges of muscular lamellæ, a provision probably enabling them to fix on the walls of the tube with greater accuracy.

A variety which occurs abundantly at North Uist, and is characterised by the sharp spike over the aperture of the tube and almost invariably a three-pronged operculum, has hooks which deviate from those at St. Andrews, for they form a long triangle and have a larger number of teeth above the modified main fang, viz., eight in the anterior hooks and nine or ten in the posterior. A similar spike over the aperture is met with at St. Andrews.

Habits. The species has great vitality, surviving in impure water or living in a small quantity of unchanged sea-water for a week. One example from St. Andrews reached Perth on the 14th February, and lived till it was preserved on July 3rd in a jug of sea-water—meanwhile having made a considerable addition to its tube, the new portion being distinguished by its pure white colour. The rapid growth of the tube of the corresponding development of the annelid is sufficiently shown by the presence of well-developed examples on the carapace of the adult *Carcinus mænas*. Orton *, indeed (1914), found that it grew to nearly full size in four months, and at this age the ova yielded practically 100 per cent. of embryos on being artificially fertilized.

The collar in *Placostegus tridentatus*, J. C. Fabricius, the sixth form, is so thin as to be diaphanous, but it is deep, and it is joined by the alar membrane dorsally on each side of the hiatus, passing thereafter across the ventral surface to

* Journ. M. B. A. vol. x. p. 316.

the other side. It is usually thrown into various frills, but it presents no notch or break, though it is easily lacerated.

The branchiæ are about twenty-eight in each fan, of considerable length, the filaments little tapered, and ending in a short subulate process. The pinnæ are comparatively short, but they pass to the base of the terminal process without apparent diminution, so that the effect is to widen the tip. No skeletogenous element appears in either filament or pinna, but the cuticle of the former is thick.

The operculum arises by a stout pedicle on the dorsal edge of the left fan, which is considerably thicker than a branchial filament. The pedicle is flattened inferiorly, gradually dilates in its upward course, and then enlarges into the clavate operculum, which is truncated and hollowed out, yellowish when seen laterally, somewhat olivaceous on its distal surface. In lateral view the ventral outline of the apparatus is the more convex, the dorsal being nearly straight.

The body is widest anteriorly, the alar membrane increasing its bulk in this region, then tapers a little to the tail with the anus at the tip posteriorly. It is rounded dorsally, slightly flattened ventrally, where a median groove runs throughout the posterior region.

Six pairs of bristle-bundles occur in the anterior region, as in *Pomatocerus*, and each has three fascicles. The pale golden bristles are a little narrowed at the insertion, have straight shafts, and slightly curved tapering tips, which end in translucent hair-points, and with very narrow wings. The posterior bristles are few in number, two or three, as a rule, being in each foot. The shaft is slender and nearly cylindrical, but is narrowed below the distal enlargement, which forms a flattened blade with an almost transversely spinous distal edge, one angle of which is produced into a short whip or pointed process. It is remarkable how closely such a bristle resembles the brush-shaped forms of the Eunicidæ and other groups.

The anterior hooks are in single rows, very numerous and fairly large, but it is difficult from their translucency to define their exact outline. The anterior edge is nearly straight and saw-like from minute denticulations, the last of which (probably corresponding to the main fang) projects outward and downward as a minute blunt process, the body of the hook forming a narrow, flattened, and transparent bar. The crown is small and rounded, and the whole body of the hook is easily curved under pressure.

The posterior hooks do not differ essentially in structure or arrangement, though they are smaller.

Reproduction.—An example procured off North Unst by Dr. Gwyn Jeffreys in July had a series of ova in a hollow on the ventral surface behind the anterior region.

The tube is of great density, slightly translucent or vitreous, and has anteriorly a sharp dorsal spike and two infero-lateral spikes. A serrated keel runs along the mid-dorsal line, and the tube is fixed to shells, stones, or other submarine bodies. The inner surface is smooth and vitreous, and the minute teeth along the anterior edge of the hook must be of great hardness. Whilst the initial coil is adherent the distal end stands up freely in many cases. When densely grouped on stones the tubes are less rough and the aperture is smoother, and as they are coiled and interwoven, with their ends often free, a considerable change takes place in the facies of the tube. It still retains its median ridge, but in a modified form. The whole aspect of the mass is in contrast with the ordinary conditions of the species. Yet here and there at the edges the usual aspect is observed. The examples indicated came from the deeper water off St. Andrew's Bay, attached to sandstone and accompanied by the tubes of *Sabellaria*.

In *Apomatus ampulliferus*, Phil., the seventh form, the collar is less developed than in *Placostegus*, but though narrower it is thicker and follows a similar arrangement, as starting from the dorsal edge of the fused collar and alar membrane it passes as a continuous fold across the ventral aspect to the opposite side. The truncated anterior end after removal of the branchiæ presents a somewhat rounded central elevation with a fossa between it and the collar.

The branchiæ are reddish in life and are seven in number on each side. They are of moderate length, somewhat soft and thick, and in the preparations are usually coiled and doubled. The broad filaments taper slightly toward the extremity, and end in a subulate process, the pinnæ extending almost as far, so closely do they approach the tip. The tissue of the filaments is lax, so that doubling readily occurs, and both they and the pinnæ have hypodermic glandular cells, the tissue of the ciliated pinnæ being especially soft, one moniliform blood-vessel being conspicuous. Instead of the firm hyaline cuticle of other

forms, this apparently has a very thin cuticle, the cells and granules of the hypoderm almost reaching the surface.

Marion and Bobretzky speak of a second operculum on another of the filaments. Their *Apomatus assimilis* differs in having "cystallins" on the branchial filaments, but perhaps this is only a variety of the above, which occasionally shows pigment-specks at the base of the branchiæ. A second small operculum is occasionally observed in those from the Channel Islands—arising, as in the case of the larger, from the tip of a branchial filament.

The operculum is a soft globular enlargement on the end of a branchial filament, of the ordinary character as regards general structure and the presence of pinnæ. It consists of a layer of cuticle with a granular coat internally, and, moreover, the globe contains several branching filaments, resembling modified distal processes, which extend to the free end of the operculum. While thus serving as a plug to the aperture, the operculum would also appear to perform a respiratory function and it is filled with fluid. The branchia bearing the operculum tapers little, and the pinnæ pass up to its termination. A constriction then occurs, followed by the slightly enlarged though short opercular pedicle, which is again slightly constricted at its junction with the operculum. In an example from St. Peter Port the operculum showed no branching filaments, so that this may be occasional or, perhaps, due to a parasitic growth.

The body of the preserved animal is somewhat stout and short, the posterior region being especially massive, and it tapers only a little to the slightly flattened tail. The anterior region has a broad alar membrane, whilst the mid-dorsum is distinguished by a long conical elevation with the apex directed forward and a median furrow, the rest of the dorsum being more or less convex, except in the instance where the hollows were filled with ova. The ventral surface is rather convex than flattened, but it has a median groove from end to end with the exception of the break at the alar fold.

The collar-bristles form two conspicuous tufts, slanting obliquely forward and outward from a point a little in front of the bases of the first lateral tuft. They appear to have the same structure.

The anterior region has six lateral setigerous processes on the ventral side of the alar membrane, and six elevated rows of hooks to their ventral edge. All the bristles are directed upward and backward, and have a uniform structure, viz., a straight shaft, narrowed at the insertion, then remaining

cylindrical to the curvature at the tip, after which it tapers to a fine point. Serrated wings commence a little below the curvature, widen, and then diminish distally. Bristles appear to be absent in the anterior part of the posterior region, only about twelve to fifteen of the terminal segments having a pair of bristles on each side. The more anterior of these have short straight shafts and sickle-shaped tips, the broad tapering blade having its edge serrated. Toward the tip of the tail, however, the terminal blade is knife-shaped and less curved, a slight enlargement occurring at the end of the shaft. Faint striæ in all cross the tip obliquely from the serrations.

The anterior hooks are very diaphanous, with a minutely serrated anterior margin ending inferiorly in a slightly projecting and modified (blunt) main fang, below which a gulf occurs above the prow. The crown is rounded, and the posterior outline has a deep indentation. The body of the hook is faintly striated from the anterior face to the base. The posterior hooks do not differ except in size.

The collar in *Ditrypa arietina*, O. F. Müller, the eighth species, though deep, is very thin and its edges lacinated, whilst its surface is marked by the linear streaks caused by the adpressed branchiæ. It is fissured in the mid-dorsal line, but appears to be continuous from side to side across the ventral surface. No alar membrane is visible dorsally, though a trace of it probably exists.

The branchiæ are of considerable length, arranged in two semicircles of about a dozen filaments in each, and appear to adhere closely together, as if they were bound by a delicate web, though this has not been clearly made out except at the base. The filaments taper from base to apex, and end in a short process which scarcely projects further than the adjoining pinnæ, though it is twice as thick and presents a more distinct central space, whilst its surface has cilia. The pinnæ are long, in a double row, and are so arranged distally that they form a nearly even series, and thus give a character to the tip of the branchiæ. Like the filament, they possess no skeletogenous elements, though in the former the cuticle is thick and tough. The free terminal process of the filaments may have special branchial functions when the animal withdraws into its tube, for they project all round in the space below the opercular plug.

The pedicle of the operculum is long, and springs from the dorsal edge of the left branchial fan, and it remains nearly cylindrical to the tips of the branchiæ, where it

dilates into the long and shapely vase with the yellowish-green or dull yellow calcareous plate, 1.20 mm. in diameter, at its tip. The projection of the operculum proper beyond the terminal processes of the branchiæ is noteworthy. In the ordinary spirit-preparations the pedicle lies in the midst of the branchial filaments, and is thus in contrast with the condition usually seen in other forms. The distal opercular plate is flat and brittle, presenting under the microscope a deep yellow hue and a minutely cellulo-granular aspect, the margin, however, being hyaline. The pedicle is flattened inferiorly, but toward the base of the opercular vase it is rounded.

The body, which is 13–16 mm. or more in spirit, has not been observed in the free condition, all being moulded by the tube into a cylindrical form anteriorly, and only a little tapered toward the tail, which has a short, conical outline. The anterior region is distinguished by the six pairs of bristles laterally, by an anterior achetous segment, and by the fillet with a median notch ventrally—the representative of the broad fold in most Serpulids. The posterior region consists of numerous (50–55) narrow segments, most of which are devoid of bristles, and it terminates in a somewhat broad flattened tail, with two rounded and sometimes prominent anal papillæ (cirri). The first segment anteriorly contains the two excretory organs, the canals of which unite to open between the two branchial lobes.

The anterior bristles dilate a little above the insertion, the shaft then being cylindrical to the commencement of the tip, which tapers to a delicate point and has narrow wings. The posterior region presents only one or two simple tapering bristles in each segment toward the tail. These bristles are usually slightly curved.

The anterior hooks are numerous (220, *De St. Joseph*) in each row which runs ventrally from the bristle-tuft. The crown is small, the anterior edge covered with many (twenty to twenty-two, *De St. Joseph*) regularly arranged sharp teeth, and the main fang is well developed, though not sharp; whilst beneath it is a shallow gulf or notch with a mere rudiment of a prow before merging into the inferior border, which is nearly straight. The posterior outline presents only a trace of an incurvation, and the striæ on the body of the hook incline from the front obliquely toward it. The entire hook is thin and translucent. The posterior hooks are fewer in number in each row, and

considerably smaller, but their structure is the same. All the hooks when in position have their teeth directed forward.

The tube is vitreous throughout the greater part of its thickness, but the inner lining is opaque white, and its shape is that of a long and sharp-pointed elephant's tusk. The anterior aperture is neatly rounded, but not dilated, whilst by the gradual thinning of the outer layer a character is given to it. The posterior end presents a minute aperture. It measures from 25 to 35 mm. in length, and its wider region in front is from 2 to 2.3 mm.

Various structures affect the external surface of the tube, such as corals, other Serpulids (for example, *Hydroides*, *Serpula vermicularis*, and *Spirorbis*), Polyzoa, and Sponges. It is a favourite site for Lepraliæ. A southern variety from Bona Bay is considerably smaller, the largest being 25 mm. long, is characterized by its brownish hue. In the Zetlandic examples comparatively few abnormalities occur amongst hundreds. Occasionally a constriction of the shell is observed toward the wide anterior region, or the rings of growth here and there are unusually prominent. Under favourable conditions the delicate posterior end with its greater curvature is entire, forming a needle-like commencement to the tube. Rarely, as in certain Zetlandic examples, a lateral ridge on each side runs from the anterior aperture to the posterior end.

A rather rare species is *Spirorbis caulleryi*, sp. n., from the under surface of stones in tidal pools in Guernsey and Herm, and in this the cephalic collar is normal and forms a sheath for the branchiæ, which are seven or eight on each side.

The body is typical in outline, and has seven bristled segments. The first or collar-series consists of bristles which have no distinct gap at the base of the tapered terminal blade or a modified one. The former kind occurs in one group, the straight shaft slightly dilates at the shoulder, from which the tip is bent backward and coarsely serrated, the serrations next the shoulder being perhaps less distinct than those which follow. The other group presents a distinct differentiation of the base of the terminal blade, the separated part at the shoulder having finer serrations, the edge beyond (bearing the distinct serrations) being separated by a distinct step. The base of the blade has five or six teeth at least in lateral view, and in antero-posterior view this part appears to form a spiked collar to the anterior edge of the bristle. The serrations on the terminal blade vary, some having fine, others coarse points. The second bristle-tufts of the region

have straight shafts and tapered winged tips bent at a slight angle. The bristles of the third tuft have in the peculiar group a slightly curved tip (sickle-shaped) with the serrations only at the tip, as described by Caullery and Mesnil in *Spirorbis cancellatus*. The bristles of the posterior region have broad tapering tips, bent nearly at a right angle, with the edge coarsely serrated.

The branchiae are about four in number on each side, and do not offer any noteworthy peculiarity.

The operculum is circular and hollowed out distally like a saucer, with a short stalk or process like a reversed cone. In young examples it is circular, forming a saucer-shaped disc, but in the older forms it is sometimes nail-shaped—that is, the circular shape is lost by an extension of one edge toward the stalk. Externally is the clear outer investment of the rim of the operculum, within which is a radially arranged layer at right angles to it; then follows a broad belt of circular fibres with strong longitudinal fibres converging to the stalk. The calcareous investment is very brittle.

The tube is vitreous and peculiarly coiled, so that the aperture is on the summit of the spire. The whorls are boldly ridged, and the ridges affect the shape of the aperture, which is sometimes transversely elongated. The whorls form a conical mass with a flattened under surface, in the centre of which is the primary coil. The shape is thus like an irregular blunt cone, and the shell is very hard and glistens like pinkish porcelain.

The *Spirorbis violaceus* of Levinsen somewhat resembles the bluish *S. vitreus*, O. Fabr., from the Arctic seas, as usually observed on pebbles and stones, the aperture in both tubes being on the summit of the coils; but the camerated condition of the sulci of the outer whorls in the Arctic form is not seen in the southern type. Both differ essentially from the present species.

It also diverges from the *S. violaceus* of Levinsen in having a more or less distinct gap above the crenulate web at the base of the tip of the collar-bristles, and in the same way differs from the older specimens mentioned and figured by Caullery and Mesnil. No simple serrate tip was observed in any example, though some have a differentiated base without a distinct gap. The operculum does not differ materially from the figures and descriptions of *S. violaceus* given by the French authors just mentioned, the ringed condition and saucer-shaped tip being evident.

The next, or tenth, form, *Spirorbis spirillum*, L., is everywhere abundant round the British shores on zoophytes, Fuci, algæ, *Corallina officinalis*, *Flustra*, and other structures. The collar agrees with that in other Spirorbids in being widely split posteriorly, but continuous in front. Its connection with the membrane of the anterior setigerous region is also normal. The branchiæ appear to be few, viz., four on each side, and the terminal processes of the filaments are short, so that they do not project beyond the pinnæ, which thus form a more or less even tip, since the distal pinnæ are short.

The operculum forms a shallow vase with a foot or process beneath, the edge of the latter being crenate. There is no space for opercular embryonic development in this species.

The body is widest in front, and gradually tapers to the tail which is normal. The collar-bristles are characterized by the absence of the gap near the base of the terminal blade. They are comparatively small, have long straight shafts, which dilate on reaching the distal shoulder, the terminal region being sharply bent backward, tapered to a fine point, and rather coarsely serrated along the edge especially at the base. The other bristles conform to the usual type. The figure of the collar-bristle, as given by Miss Pixell*, from the Pacific Coast of North America, diverges considerably from the British form, the tip being shorter and broader.

The second fascicle consists of simple winged bristles.

The posterior bristles have the tips bent at an angle or "kneed," and usually project little in the preparations.

Few forms appear to have had greater vicissitudes in nomenclature than the next, or eleventh, species, viz., *Spirorbis granulatus*, L., a form which essentially differs from the *Spirorbis granulatus*, L., of Caullery and Mesnil †, from Greenland and Nova Zembla, since the globular form of the operculum, as figured by the French authors, no less than its ovigerous character, separate it from the present species, which, as Fleming ‡ truly said in 1825, occurs "on old shells, but more frequently on the underside of loose stones about low-water mark, very common." It is especially abundant on the rocks and stones in rock-pools at St. Andrews. The branchiæ are pale, ten in number, and the cuticle of the filaments is thin, so that the hypodermic elements form the main support.

* Proc. Zool. Soc. 1912, pl. lxxxviii. fig. 8 c.

† Bull. Soc. France, Belgique, t. xxx. p. 216, pl. x. fig. 26.

‡ Edinb. Philos. Journ. vol. xii. p. 244.

The filaments taper from base to apex, and end in a somewhat long non-ciliated process containing a blood-vessel and which in life projects beyond the pinnae, though in the preparations the long terminal pinnae extend even beyond it. The pinnae are long throughout, and are richly ciliated. No skeletogenous elements are present in these or in the filaments, which, however, have a band of muscular fibres passing from the base to the tip, but they do not appear to enter the terminal process. The entire branchial system, indeed, is eminently contractile and under voluntary control. The cilia on the pinnae are large and long, and appear to be under the control of the animal, since they remain quiescent for a time and then commence to vibrate rapidly. The branchiae on the approach of danger are shortened, grouped together, and drawn in, the operculum following and closing the tube. The pinnae have a dotted aspect from the grouping of the cilia in tufts, though this may only be apparent; moreover, the movement of each pinna is independent of the others, so that it bends downward, jerks inward, and performs various motions with celerity and accuracy. The wall is composed of firm mucoid (hypodermic) cells and a greenish blood-vessel occurs in the centre, the fluid therein being devoid of corpuscles. In contraction the pinnae are, by their muscular elements, only slightly shortened and narrowed, so that when the branchial apparatus is again unfolded the elastic nature of the tissues readily restores them to the former size.

The operculum is funnel- or vase-shaped, hollow at the tip, and gradually dilating from the stalk upward. The distal plate is calcareous (effervescing under HCl) and the muscular fibres pass from the pedicle to the enlarged opercular region, in which they spread out in a fan-like manner to be attached to the distal cup. No trace of a central cavity exists in this form, though a calcareous mass occurs in the centre below the operculum, and its shape differs from that in the developing young of other forms.

When removed from its tube the anterior region of the body is pale, but the rest is of a pale grass-green. It is widest anteriorly, and tapers posteriorly to a bluntly conical tail, a rounded papilla being on each side of the anus. The anterior region has four pairs of bristle-bundles, whilst the posterior region consists of nineteen or twenty segments. No cilia were observed on the anterior region, but they occurred dorsally on the swollen greenish posterior region, and were vigorous toward the tail—indeed, by far the greater part of the body is supplied with cilia.

The cœlomic space is richly ciliated, and thus the contained cells and granules are kept in active motion, a stream of them proceeding posteriorly, and, it may be, escaping by a rupture of the body-wall.

The intestinal canal is enlarged immediately behind the anterior region, and such may represent the stomach, for a gizzard-like portion is marked off by constrictions in front of it. It is ciliated from this region to the vent, and elongated collections of particles are often observed in motion in the interior of the gut.

Two brownish-green granular glands lie obliquely on each side of the gizzard-like portion of the alimentary canal.

The first or collar-bristles differ from those which succeed not only in size but in direction and structure. Each consists of a long straight shaft, slightly dilated and flattened as it approaches the tip which is curved backward, and with fine serrations at its rounded base, their size, however, increasing as the gap is approached, three or four being especially prominent next the notch, then the blade has a smooth portion, after which the edge is finely serrated to the delicately tapered extremity. Amongst these are a shorter series of more slender bristles with simple tapering tips. This bristle-tuft is directed forward nearly in a line with the long axis of the body, and the bristles are larger and longer than those which follow. The three sets of paired bristles which succeed are simple and spear-shaped, with slightly curved tips, the third or last pair having the tips of the bristles somewhat broader.

The posterior bristles are placed in pairs on each edge of the segments of the region, and in outline they somewhat resemble an ancient long-toed boot with the sole (edge) serrated. They diminish in size from before backward.

The greenish circulatory fluid is carried forward by a dorsal vessel, which is often curved in each segment over the alimentary canal, and backward by a ventral trunk.

In an example from St. Andrews, in which the collar-bristles had apparently been broken, the terminal blade was finely tapered and translucent without evident trace of serrations, whilst the basal web was coarsely spinose.

The anterior hooks have a long and minutely serrate anterior edge, but the main fang inferiorly is short in lateral view, and when looked at on end is flattened and bifid. The posterior hooks do not differ in structure, but are smaller.

Very abundant likewise in British waters is *Spirorbis*

borealis, Daudin, the twelfth species, and it swarms equally on the blades of the *Fuci* rocks and *Laminariæ* in the south as on those in the north. This species also has many synonyms, from the *Serpula spirorbis*, L., the *Vermiculus exiguus albus nautiloides* of Lister, the *Planorbis minimus* of Peters, to *Spirorbis communis*, *S. reversa*, *S. baltica*, and *S. linnei* of others.

The collar is open as usual in the mid-dorsal line, but continuous ventrally, and it joins the membrane of the anterior setigerous region which De St. Joseph has occasionally found of a bluish tint. The membrane passes ventrally behind the last bristle-tuft and fuses with that of the opposite side. At the base of the branchiæ are two minute eyes on the dorsum.

The branchiæ are four on each side, each filament having a short, slender, and slightly tapered terminal process, and bearing from sixteen to twenty pairs of rather long ciliated and nearly cylindrical pinuæ, which do not arise quite opposite each other. Their colour is dull yellow, with a tinge of green from the blood-vessels. They are sensitive organs, receding with a jerk into the tube on being touched.

The operculum, derived from the first left branchia, is saucer-shaped, with a massive peduncle, is calcareous and often infested by diatoms and other structures. De St. Joseph found *Cothurina maritima* growing on the operculum, and reproducing by fissiparity.

The body is dark brown in front from the alimentary canal, reddish-orange posteriorly, and 3 to 4 mm. in length. The anterior region has three bristled segments, the first series having characteristic tips. The first part of the posterior region of the body is not segmented, though ciliated, the total number of segments being 18-32, and terminated by the anus with a rounded papilla on each side. Each segment has two geniculate bristles. In the first segment are two excretory organs, from which ciliated canals join to form a single duct opening at the base of the branchiæ.

De St. Joseph describes the alimentary apparatus as composed of an œsophagus in the anterior region, a large, brown cylindrical stomach immediately behind, followed by a sinuous intestine. He found spicules of sponges, diatoms, amongst others *Sphenosira catena* in the stomach, all probably carried in by muddy currents. A blood-sinus encircles the canal, with lateral branches and cæca in each segment.

The first bristles arise from a nearly cylindrical setigerous process, and differ in detail from those of *Spirorbis granu-*

latus. The shafts are less robust, though straight, and they also dilate distally into a flattened process at the commencement of the tip, but no fine serrations occur on the convex edge, the whole being occupied by two to five (Levinson shows seven) rather coarse serrations, which slightly increase in size from below upward in lateral view, the striæ on the flattened end of the shaft making them conspicuous. Then the smooth edge of the "bite" occurs as it rises to the somewhat bellied blade beyond, which, however, soon tapers to a delicate extremity, usually with a marked curvature. The bellied condition of the blade beyond the "bite" is a diagnostic feature in comparison with the bristles of *Sp. granulatus*, as also is the comparatively coarse edge, the serrations on which point upward and outward, so that a certain uniformity prevails. The basal part, moreover, is separated only by a slight "step" from the distal, and the serrations on it sometimes show a slightly different angle. Such, however, diverges from the figure of the bristle given by De St. Joseph, in which the distal serrations are at right angles to the axis of the tip, an error probably due to an indifferent microscope. The "step" of this bristle shows a distinct character when compared with the gap generally present in the collar-bristles. The shorter bristles are simple tapering forms.

The bristles of the second setigerous process are simple straight forms, the tapered tips of which are bent backward and provided with wings. The four anterior bristles of the third series agree with the foregoing in the finely-tapered winged tips, but the posterior five have broader sickle-shaped tips, with a smooth wing at the base, though the forward curve of the sickle-like blade shows long serrations so that they are pectinate, the tip being finely attenuate.

The anterior hooks are in rows of 23-55. Each forms an elongate plate, narrower at one end than the other, the anterior edge armed with about forty fine teeth. The main fang is blunt. The posterior hooks are similar, but smaller, and the number in the rows is considerably less (6-18).

The sinistral tube is shaped like the shell of a *Nautilus*, with a deep umbilicus on the free surface, and its main bulk is composed of the last coil, which often hides the earlier coils, though, in some, these are distinct in the centre. The surface of the last coil is slightly bevelled and marked by transverse lines of growth. The aperture is circular, though a process of the tube projects beyond it on the surface of the sea-weed. The tubes sometimes occur in rows and on both surfaces of the *Fucus*. De St. Joseph

met with *Folliculina ampulla* in the interior of a tube and the ova of *Automolos unipunctatus*, Graff (*Monocelis unipunctatus*, (Erst.)), and Turbellarians are not uncommon in tubes from St. Andrews and Lochmaddy.

The next, or thirteenth, species, which was probably included by Sacchi as *Serpula spirorbis* in his 'Catalogue of the Shells of Naples,' has been well known since Claparède described it as *Pileolaria militaris* in his volume on the Annelids of Naples. It is a southern type and, so far as known, has hitherto been confined in the British area to the Channel Islands, though Caullery and Mesnil found it not infrequent on the shores of France, and Langerhans mentions a form (his *Spirorbis granulatus*, L.) which these authors consider to be only a variety from Madeira. It is rarely met with in the Channel Islands.

The operculum is comparatively large, helmet-shaped, and ornamented with denticulated ridges and accessory processes. The cavity of the helmet performs the function of a brood-pouch, and, in those captured in July and August, was filled with large eggs and embryos—the breeding-season at Naples being somewhat earlier, viz., in June and July. It differs from such as *Spirorbis pagenstecheri*, De Quatrefages, in so far as the opercular helmet is ready to receive the ova without further addition or alteration. Its specific name has reference to the helmet-like condition of the operculum, which is ornamented with characteristic ridges.

The branchiæ have comparatively thick filaments which end in a long and slender process. The body is typical in outline, has a deep reddish hue, and the same colour tinges the branchiæ, the collar, and the anterior membrane (*Caullery and Mesnil*). Anterior region of three-bristled segments.

The first or collar-bristles are characterized by their size, the coarseness of their serrations, the presence of a distinct gap, and their yellow colour. Moreover, they are boldly curved at the tip, so as almost to resemble "kneed" bristles. They are accompanied by a series of simple bristles, which are widest, though they do not quite reach the size of the former bristles, at the base and gradually diminish to a delicate hair-like tip. The next bristle-tuft has capillary bristles with finely serrated rings, the shaft in each being nearly cylindrical or very slightly tapered.

The sixth species of *Spirorbis* is one originally described by Miss Pixell from the shores of British Columbia, and which Mr. Southern procured in Blacksod Bay on the West Coast of Ireland, and I am indebted to him for examples.

In this the cephalic collar is well developed, forming a sheath for the base of the tentacles. The filaments of the branchiæ, which are fourteen in number, terminate distally in a tapering subulate process, which extends considerably beyond the pinnæ. The nail-shaped operculum presents a minutely cellular or reticulated structure, when viewed by a high power from above, and a series of concentric rings. A considerable process or talon occurs beneath it, the lower edge of which varies in outline—sometimes being irregular, at other times smooth. The distal concavity frequently contains mud and minute algæ.

The body has the typical coil, three bristled segments occurring in front and twenty to thirty posteriorly. The most powerful muscle seems to be that on the concave side of the coil. The collar (first) bristles have straight shafts dilating into a broad web at the base of the tip, which is bent backward, is of moderate length, finely tapered, and minutely serrated. The basal web is striated, each of the striæ ending in a sharp point, whilst the distal blade slants obliquely to the serrated edge. The second tuft has bristles with rather broad wings, and the blade tapers rather suddenly to a very fine point, so as to give a character to the bristle. The third tuft has both winged and sickle-shaped bristles, the edge of the latter being serrated.

The posterior bristles are minute, and project little beyond the surface. They are geniculate at the tip, being bent nearly at a right angle to the shaft and coarsely serrated. The anterior hooks are stated by Miss Pixell to be of ordinary shape, with about twenty teeth. The tube is described by Miss Pixell as dextral, large and flat, thick and opaque, slightly roughened, but without definite growth-lines. A slight median ridge and sometimes one on either side; the aperture has, however, an entire margin and measures 2 mm. across. The Irish examples from Blacksod Bay, kindly forwarded by Mr. Southern, were in dense clusters on stones and shells, sometimes only the aperture being visible, whilst the tube itself formed a lax spiral, quite different from the original account of Miss Pixell, though it is still large. In lateral view the elongated spires of some of the masses gave an unusual depth to the Spirorbid coating. Some examples, indeed, formed an elongated spiral tube, after the manner of the horn of the Indian Antelope, or even that of the Koodoo. Originally the tube appears to be small and flat, then, as the annelid increases in size, the tube thickens, becomes loosely spiral, and keeps pace with the growth of sponges or other

encrusting growths, so that its rounded and dilated aperture (trumpet-like in some) is free. From Miss Pixell's description, the tubes follow another mode of growth under different circumstances.

A single example of the last species, viz., *Spirorbis pusilloides*, De St. Joseph, kindly sent by Mr. Southern, has alone been under examination, and the collar-bristles in this instance had no gap above the web, and might pass for those of *S. spirillum*. Mr. Southern, however, states that he has seen all intermediate forms between this and the typical form with the differentiation at the base of the blade. Caullery and Mesnil also found a simple geniculate condition of the collar-bristles in preparations forwarded by Baron De St. Joseph. Whether the violet pigment on the gut of *S. pagenstecheri* and the red on *S. pusilloides* denotes more than variation is uncertain. The species was first described by De St. Joseph under the name of *Mera pusilla**, but Miss Bush†, seeing that the specific name was used by Rathke in 1836 for a species from the Black Sea, proposed the present title. It chiefly occurs on shells of oysters, though Southern found it on mussels and *Trochi*.

Two forms, familiar in the literature of the subject, are not entered here, viz., *Spirorbis heterostrophus*, Montagu, and *Spirorbis carinatus*, Montagu, since both are probably included in the forms dealt with, and, at any rate, the uncertainty can only be removed by a careful examination of fresh animals. Miss Bush and others do not seem to have formed a definite opinion about either.

Montagu (1803)‡ describes *Spirorbis heterostrophus* as having "a strong, spiral shell, of a dirty white colour, with two or three reverse volutions placed laterally, furnished with three longitudinal ridges, one along the back, and another on each side, roughly wrinkled transversely; the base is flat and somewhat spreading; aperture orbicular, and invariably placed opposite the sun's apparent motion. Diameter not a line."

He procured it on oyster and other shells and on algæ. It is readily distinguished from *S. spirorbis* by the longitudinal ridges, and by the contrary turn of the volutions. Under slate-stones at Kingsbridge Bay in great abundance (covering

* Ann. Sc. Nat. 7^e sér. xvii. p. 351, pl. xiii. figs. 388-392.

† 'Tubicolous Annelids from the Pacific' (Harriman), Alaska Exped., 1908, p. 250.

‡ Test. Brit. vol. ii. p. 50^o.

the surface), between tide-marks. He thought the sub-saline quality of the water so far up this inlet, at ebb-tides, not congenial to other forms. The tube at first sight resembles that of *S. granulatus*, but appears to be coiled from right to left, whereas that of the common form is sinistral. It shows a deep groove on the summit and two ridges. Occasionally the aperture of the tube is turned upward. All the specimens are of one size and small, so that they may not be adult.

Montagu* found *Spirorbis carinatus* common on *Arca pilosa* and *Pinna ingens* on the south coast, and describes it as having "a dull, opaque, white, spiral shell; the outer 'whirl' rising into a carinated ridge on the top; the middle concave, sometimes pervious; the interior volutions inconspicuous; base a little spreading; aperture round. Size about half that of the *S. spirorbis*, from which it is readily distinguished by the angulated shape of the exterior 'whirl,' which is formed like *S. triquetra*, but always regularly spiral." Fleming† adds little to the original description, though he states that the "surface is transversely wrinkled, the whole less regular than the preceding (*S. granulatus*), with the aperture more ascending." His examples appear to have come from Shetland. Miss Bush‡ thinks Fleming's form approaches *S. quadrangularis*, Stimpson, adding, "but it is not improbable both species occur on the English coast." She alludes to two forms, one dextral from Guernsey and Ireland, the other sinistral from England, but comes to no definite conclusion.

The tubes from Exmouth (1822) are small, and have a reversed coil (sinistral) to that of *Spirorbis heterostrophus*. The inner side of the last whorl is broadly grooved, whilst a ridge runs along the top of the coil. The aperture is round, the centre is either filled up by the early coils or is blank—forming a large umbilicus. It resembles a young *Spirorbis granulatus*, but only one groove is distinct. Levisen, again (1883), shows two ridges in his figure, and is of opinion that it is synonymous with *S. quadrangularis*, Stimpson.

In the British Museum § a specimen labelled "*Spirorbis carinatus*, Montagu," is attached to a Polyzoan like a large *Salicornaria*, from Greenland (*Copenhagen Museum*). The specimen has branchiæ with long, tapering, terminal

* Test. Brit. ii. p. 502 (1803).

† Edinb. Philos. Journ. vol. xii. p. 244.

‡ 'Tubicolous Annelids from the Pacific,' p. 249.

§ I am indebted to Dr. Harmer, Dr. Calman, and Mr. Tate Regan for their courteous aid in the examination of this and other specimens.

processes, an operculum, the calcareous plate of which is rounded, whilst the anterior region has three pairs of bristles. The collar-bristles have the rather long triangular web at the commencement of the tip furnished with numerous small serrations, only the upper one or two being larger, a rather shallow gap above it, and a tapering blade with a finely serrated edge. These bristles thus approach those of *Spirorbis granulatus* and *S. borealis*. The third series appears to have sickle-shaped bristles. The tube has three sharp ridges and two grooves, the ridges differing from those of *S. granulatus* in their spinous edge, and the median ridge in some becomes deeper at the aperture, so that it forms a conspicuous keel, with a small sharp point over the circular aperture.

4. On a *Placostegus* from the 'Porcupine' Expedition of 1870.

The examples were dredged six miles from shore off Cape de Gatte in 60-160 fathoms in the 'Porcupine' Expedition of 1870, attached to small stones. It is distinguished from the northern *Placostegus tridentatus* by the longer and more slender tube, which may be curved here and there but not coiled, and by the presence of three coarsely serrated ridges (a dorsal and two lateral). The three spines at the aperture also differ in character, since they are longer and curved outward.

The thin diaphanous collar seems to have the same arrangement as in *P. tridentatus*, but the branchiæ are proportionally longer and less numerous, viz., 11-12 in each fan, the filaments taper a little from base to apex, where a longer terminal subulate process than in the former species occurs. The long pinnae, however, continue to its base. The opercular stalk is slender and remains nearly of the same diameter to the base of the vase-shaped operculum, which, though smaller, is more elegant in shape than in *P. tridentatus*. The truncated distal end is hollow and horny, the rim only being yellowish.

The body is long and narrow, with six bristled segments anteriorly, and numerous posterior segments which are flattened toward the tail and end in an anus with a distinct and rounded papilla at each side. The six setigerous processes anteriorly have tufts of the same kind, viz., bristles with straight shafts, very slightly bent tips with narrow wings, in which respects they do not materially differ from those of *P. tridentatus*. Posteriorly bristles seemed to be absent

until near the tip of the tail, where each segment has a single, long, slender, tapering bristle or two. The brush-like bristles, however, are not absent, since they occur toward the posterior end, in front of the simple forms. Each has a slender straight stem, which dilates distally into the flattened spinous tip, one side of which has a minute whip or pointed process, the tip being thus asymmetrical. The anterior hooks appear to be proportionally smaller and broader than in *P. tridentatus*, and the modified main fang is indistinct. In both the serrations of the anterior edge resemble transverse grooves of a file, but they are perhaps broader and more distinct in the present form. The posterior hooks are slightly less, but agree in structure with the foregoing.

The tube is small, elongated, tapered posteriorly, and fixed to small pebbles. The dorsal and two lateral spinous ridges are diagnostic when compared with the tube of *P. tridentatus*, for the spinous processes on each are isolated and prominent, as well as occasionally curved, as are also the three anterior spines. Moreover, the entire tube is more transparent than in *P. tridentatus*, and the spines especially so. It may represent, however, only a variety of *P. tridentatus*, J. C. Fabricius.

XIX.—*Parapherusa crassipes* (Haswell), an Amphipod of Australasian Seas. By CHAS. CHILTON, M.A., D.Sc., LL.D., F.L.S., C.M.Z.S., Professor of Biology, Canterbury College, New Zealand.

[Plates VIII.-X.]

IN 1879 Haswell described a new genus and species of Amphipod from Clark Island, Port Jackson, New South Wales, giving it the name of *Harmonia crassipes*, the name being misprinted *Harmomia* on the original page (p. 330), but correctly spelt in the explanation of the plates (p. 349). In 1880, in his 'Preliminary Report on the Australian Amphipoda,' he used the name *Chloris* in referring to this genus. It was included in the 'Catalogue of the Australian Crustacea' published in 1882 under the name *Harmonia crassipes*. In 1883 I recorded the species from Lyttelton, New Zealand, and added a description of the female, which had not been described by Haswell. In establishing the genus Haswell stated that it had affinities with *Eurystheus*

and *Amathia*, being "distinguished from the former by the form of the telson and the stoutness of the peræopoda, and from the latter mainly by the large size of the second gnathopoda." Before recognizing that the species I had found at Lyttelton was the same as Haswell's, I had begun to describe it as a new species of *Eurystheus*. In 1885 Haswell stated that the relations of the species were not correctly expressed by the position in which it was placed in the 'Catalogue of Australian Crustacea,' and that it belonged to the Corophiidae. He gave a new definition of the genus, still retaining the erroneous statement that the maxillipeds had "a squamiform plate on the basos only," and describing the terminal uropoda as "biramous, the outer ramus with slightly hooked spines and straight hairs, the inner with straight hairs only."

In 1893 Della Valle gave the species as doubtfully belonging to the genus *Protomedeia*. In 'Das Tierreich, Amphipoda' (1906, p. 383), Stebbing renamed the genus *Amphierusa*, as the names *Harmonia* and *Chloris* were both preoccupied, and placed it in the family Gammaridae between the genera *Paramicruropus* and *Amathillopsis*, and he retained it under the Gammaridae in 1910.

As there has thus been some difference of opinion as to the systematic position of this Amphipod, and as there are several points in its structure that have not yet been fully described, the following account may be acceptable:—

In most respects (*i. e.*, in the mouth-parts, gnathopods, and pereopods) the species shows well the general characters of the Gammaridae, the form of the palp of the mandible being like that of many Gammaridae, and showing that it cannot come near to *Eurystheus*, as was originally supposed. In the first antenna the secondary appendage is long, being nearly half as long as the primary flagellum, and both the first and the second antennæ are fringed on the underside with long slender setæ, giving an appearance not unlike that found in some species of *Eurystheus*. The greatly broadened peræopods again are paralleled by some species of *Eurystheus*, and so is the long spine arising from the peduncle between the rami of the first uropod. On the other hand, the telson, though single and somewhat thick and apparently partially rolled up, being convex above, shows neither hooks nor the special character of that of *Eurystheus* and allied genera. The outer ramus of the third uropod bears, *in the male*, a peculiar stout seta or spinule dentate towards the end, some of the other setæ are slightly curved towards the end and finely serrate, but they seem quite distinct from the definite hooked setæ found in *Jassa* (formerly known as *Podocerus*)

and in some genera of the Corophiidae. Moreover, the character described above is found only in the male; the female differs in that both rami of the uropod are more slender and bear simple setæ of the ordinary type.

It appears, therefore, that the characters which were thought to show resemblance to *Eurystheus* and the Corophiidae are superficial only, and the position in which Stebbing has placed the species is probably the correct one, though the difficulty of arranging the genera of the family Gammaridae according to their affinities is, in the present state of our knowledge, very great.

Genus PARAPHERUSA, Stebbing, 1906.

Harmonia, Haswell, 1879, }
Chloris, Haswell, 1880, } preoccupied.

As there is only one species at present known in this genus, the characters of the genus must be looked upon as provisional only. They are described by Stebbing as follows:—

“Side-plates shallow. Antenna 1 the shorter, accessory flagellum well developed. Mouth-parts normal. Mandible: second joint of palp as long as third, but stouter. Maxilla 1: inner plate with about ten long setæ, outer with eleven spines; second joint of palp with seven or eight spine-teeth. Maxilla 2, inner plate fringed on inner margin. Maxillipeds: inner and outer plates well armed. Gnathopods 1 and 2 subchelate, second much the larger in ♂, but not in ♀. Peræopods 3–5 very stout. Uropod 3 very short, rami equal, shorter than peduncle. Telson simple.”

Parapherusa crassipes (Haswell).

(Pls. VIII.–X. figs. 1–24.)

Harmonia crassipes, Haswell, 1879, Proc. Linn. Soc. N.S.W. vol. iv. pp. 330, 349, pl. xix. fig. 3; Haswell, 1882, Cat. Australian Crustacea, p. 251; Haswell, 1885, Proc. Linn. Soc. N.S.W. vol. x. p. 106, pl. xvi. fig. 9; Chilton, 1883, Trans. N.Z. Inst. vol. xv. p. 82, pl. ii. fig. 5; Della Valle, 1883, Fauna und Flora des Golfes von Neapel, vol. xx. p. 442.

Parapherusa crassipes, Stebbing, 1906, Das Tierreich, vol. xxi., Amphipoda, p. 383; Stebbing, 1910, Australian Museum, Memoir 4, p. 641; Chilton, 1909, Subantarctic Islands of New Zealand, p. 630.

Chloris, Haswell, 1880, Ann. & Mag. Nat. Hist. ser. 5, vol. v. p. 33.

Specific diagnosis.—Pleon-segments 5 and 6 very short. Eyes narrow, reniform. Antenna 1 about half the length of body and as long as antenna 2; flagellum longer than peduncle, accessory flagellum well developed. Antenna 2

with flagellum subequal to peduncle. Gnathopod 1, in female, with carpus and propod subequal in length, propod oval, palm convex and occupying about half the hind margin; in the mature male the propod widens at the base and has a very short, projecting, serrate hind margin, the palm slightly concave. Gnathopod 2 in female like gnathopod 1, but larger, and with carpus shorter and triangular; in the male, carpus very short, cup-shaped; propod very large, oblong, palm only slightly oblique, well defined, undulating, with flat-topped teeth. Peræopoda 3, 4, 5 very stout, subequal in length. Uropod 1 with long curved spine arising from end of peduncle and lying between the rami; uropod 3 in the female with both rami slender, about as long as the peduncle; in the male both rami much shorter than peduncle, the outer bearing a peculiar spinule serrate towards the end.

Colour brown.

Length 4 mm.

Port Jackson, New South Wales; Griffith's Point, Victoria; New Zealand, Antipodes Island.

The specific diagnosis given above has been modified from that given by Stebbing. It may be supplemented by the following fuller description:—

First antennæ (Pl. VIII. fig. 1) subequal to or slightly shorter than the lower, second joint of peduncle equal in length to the first, but more slender; the third about half the length of the second; flagellum nearly twice as long as the peduncle, of twenty to thirty joints; accessory flagellum long, more than one-third the length of the primary, and consisting of about nine to twelve joints; the joints of the peduncle and the more proximal portions of the flagellum bear small tufts of long setæ, considerably longer than the width of the joints from which they arise; towards the end of the flagellum these setæ become progressively fewer in number and shorter.

Second antennæ (fig. 1): gland-cone very short, last two joints of peduncle subequal, both with numerous tufts of long setæ projecting towards the underside of the appendage; the flagellum is slightly longer than the peduncle and contains about fifteen to twenty joints, the more proximal ones bearing long setæ similar to those on the peduncle.

Upper lip (fig. 2) with distal border regularly convex and fringed with the usual closely-set setæ; attached to this lip is a triangular structure, the *epistome*, which has the extremity rounded.

The *mandible* (figs. 3, 4, 5) is of normal form, with cutting-edge, spine-row, and molar tubercle all well developed;

in the palp the first segment is short, less than half the length of the second, the second and third are subequal, but the third is more slender; the second bears on the inner convex side about a dozen long setæ; on the third there is a regular double row of setæ on the distal half of the inner margin, with longer setæ near the base of the joint and two or three very long ones at its extremity. The right and left mandibles differ in the structure of the inner cutting-edge; in the left this is formed of four or five large teeth, similar to those of the outer cutting-edge, while in the right mandible it is somewhat different in shape and terminates in about six short small teeth. The spine-row contains about ten serrated spines.

The *lower lip* (fig. 6): inner lobes large and broad, almost as broad as the outer lobes; the mandibular processes are short and broad.

First maxillæ (figs. 7, 8): the inner lobe triangular, about half as long as the outer lobe, and bearing on its inner convex margin about a dozen long, slender, plumose setæ; the outer lobe with about ten or eleven spines, most of which are finely denticulate towards the ends; the palp reaching slightly beyond the outer lobe, its first joint very short; the second ends in about six short spines, and bears an oblique row of setæ on the surface near the extremity. In one maxilla the spines at the end of the palp are shorter than in the maxilla of the other side.

Second maxillæ (Pl. IX. fig. 9): both lobes short and broad, broadly rounded at the ends, and bearing at the extremity and on the distal portion of the inner margin the usual long setæ; on the inner lobe there is also an oblique row of setæ arising from the surface.

Maxillipeds (figs. 10, 11): outer and inner lobes well developed; inner lobe truncate at the extremity, with two stout, rather blunt teeth at the inner corner, and a number of simple setæ at the extremity and on the distal portion of the inner margin; the outer lobe has its inner margin bordered with about ten stout broad spines, becoming progressively larger towards the distal end; its extremity and part of its outer curved margin bear long setæ; other long setæ arise from the surface of the joint external to the stout spines; the carpal joint of the palp reaches far beyond the outer lobe and is much longer than the propod; the propod is held more or less vertically or at right angles to the plane of the base, and bears a row of five or six long setæ near its outer and upper margin, and near the inner or lower margin a rounded lobe fringed with many long setæ; other long setæ

arise at the base of this finger; the terminal joint or finger is long, curved, ending acutely, and has its inner margin finely denticulate (see fig. 11).

The *first gnathopod* in the female (fig. 12) has the side-plate almost square, the lower margin slightly convex, with a few minute setæ; the basal joint is long, about three times as long as broad; the ischium has a tuft of setæ at the postero-distal angle; the merus is almost quadrangular and bears two small tufts of setæ on the posterior margin near the distal end and a row of stouter setæ parallel to the distal margin; the carpus is slightly shorter than the propod and almost oblong, narrowing abruptly at its junction with the merus; its anterior margin is very slightly convex and bears only two or three small setæ, and there is another small tuft on the surface near the postero-distal angle; the propod is oval in outline, somewhat narrowed at the base; anterior margin regularly convex, with five or six short transverse rows of setæ, the posterior margin bearing three similar rows, and there are also three or four rows on the surface of the joint; the palm is regularly convex, not well defined, but bearing one or two stout spines and small tufts of more slender setæ near the point against which the end of the finger impinges, the rest of the palm towards the base of the finger bearing a few short setæ; the finger is strongly curved, tapering gradually to an acute point, and when closed fits closely against the palm.

In the young males the first gnathopod has the same character as that just described for the female. In the older males (fig. 13), however, the shape of the propod becomes considerably different. It is widest at the base, the palm is much longer, straight or slightly concave, and the hind margin proper becomes very short, and in place of bearing the typical transverse rows of setæ is irregularly serrate; the anterior margin and surface of the propod bear tufts of setæ similarly placed to those described in the female; the finger is more strongly curved, so that when closed there is a space between it and the palm. In the oldest males that I have been able to examine there is practically no trace left on the short hind margin of the transverse rows of setæ. In other specimens, however, presumably not so mature, this posterior margin is longer and still bears some of the setæ, though these appear to be becoming shorter and modified into the serrate surface found in the old specimens. In the female and in young males the hind margin occupies nearly one-half of the posterior margin of the propod, while in the fully developed male it forms only about a fourth of that

margin and protrudes considerably, so that the propod is then broadest at the base instead of being narrowest at the base as in the female and young male. Practically all the transition-stages between these two extremes can be found.

The *second gnathopod* in the female (fig. 14) has the same general shape as the first gnathopod, but is larger, and differs in having the carpus shorter and triangular, being only about half as long as the propod; the propod is oval, widest about the middle, narrowing a little towards the distal end. The arrangement of setæ on all the joints is practically the same as that on the first gnathopod, and can be readily understood from the figure without further description.

In the male the second gnathopod (Pl. X. fig. 15) is very large and strong, the basal joint is rather short and is broad; on the outer side the margin forms a thin flange and is produced at the distal end into a small rounded lobe, so that a groove is formed on the anterior surface of the basal joint, into which the distal portion of the limb fits when reflexed; the ischium is short and has its outer margin also produced into a small lobe; the merus is short and produced at its antero-distal angle into a subacute point; the carpus is short, triangular, and cup-shaped, being hollowed at the end to receive the greatly enlarged propod; the propod is oblong-oval, widening slightly distally; the palm is slightly oblique, well defined by a sharp tooth, and has a large flat-topped tooth near the base of the finger and a wide lobe at the centre of the palm, with a deep rounded depression at each side; the finger is particularly large and strong.

In the fully developed second gnathopod of the male the setæ are very few, sometimes there are two or three small tufts along the hind margin of the propod and a very small tuft at the distal end of the anterior margin at the base of the finger, and a few very short setæ on the palm. In still older specimens even these few setæ are hardly distinguishable, while, on the other hand, in younger males the setæ may be longer and more abundant and are present on the anterior margin as well as on the hind margin, so that the whole appendage approaches more nearly to the form found in the female.

The *first and second peræopods* (fig. 16) are moderately broad, especially the basal joint; the side-plates are rectangular in both. There are no signs of glands in any of the joints similar to those in *Jassa*, the Corophiidae, etc., and these peræopoda do not call for detailed description.

The *third, fourth, and fifth peræopods* (fig. 17) are all stout, particularly the fourth and fifth; they increase some-

what in length posteriorly, but not greatly so, the fourth and fifth being almost subequal and not very much longer than the third. The basal joint in all is oblong, not much expanded, and is narrowed a little distally; its posterior border is obscurely serrate; all the succeeding joints are stout; the merus is only slightly produced at the postero-distal angle; the propod is much longer than the carpus; the finger is short and stout, with a small secondary nail. The arrangement of the setæ on the joint can be readily seen from fig. 17.

The *first uropod* (figs. 18, 19) has the peduncle oblong, rather shorter than the rami; it bears a small spinule at the distal end of the upper margin, and from the lower part of its extremity a long curved acute spine, fully half as long as the inner ramus, projects between the two rami, recalling a similar spine found in some species of *Eurystheus*, *Corophium*, etc.; the outer ramus is slightly shorter than the inner, both bear two or three short spinules on the upper margin and longer ones at the extremity.

The *second uropod* (fig. 20) has the peduncle subequal to the inner ramus, the outer ramus being rather shorter; there is no curved spine at the extremity of the peduncle, but otherwise the uropod shows similar structure to that of the first.

The *third uropod*, in the male (figs. 21, 22), has the peduncle stout and nearly twice as long as either of the rami: these are short and broad, being less than twice as long as broad; the outer one bears at the extremity a peculiar stout seta with fine serrations towards the end (see fig. 22)—in addition to this there are five or six short setæ which are slightly curved at the end and some of which are finely serrate; the inner ramus bears at the extremity three or four setæ of the usual kind slightly longer than those on the outer ramus and one or two smaller ones placed more proximally. In the female (fig. 23) both rami are more slender and slightly longer, being about as long as the peduncle; they bear only simple setæ.

The telson (fig. 24) is slightly convex above, so that it appears fairly thick in side-view: it is broadest at the base, where the breadth is about two-thirds the length, and narrows slightly distally; the posterior border is convex and bears two small spines at each corner, and two or three smaller spines are present on each lateral margin. There is no sign on the telson of hooked spines.

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EXPLANATION OF THE PLATES.

All the figures refer to *Parapherusa crassipes*.

PLATE VIII.

- Fig.* 1. Upper and lower antennæ and anterior portion of head.
Fig. 2. Upper lip, with epistome.
Fig. 3. Left mandible.
Fig. 4. Cutting-edge of right mandible.
Fig. 5. Cutting-edge of left mandible.
Fig. 6. Lower lip.
Fig. 7. First maxilla.
Fig. 8. End of palp of first maxilla of opposite side.

PLATE IX.

- Fig.* 9. Second maxilla.
Fig. 10. Maxilliped.
Fig. 11. End of palp of maxilliped (more highly magnified).
Fig. 12. First gnathopod of female.
Fig. 13. First gnathopod of male.
Fig. 14. Second gnathopod of female.

PLATE X.

- Fig.* 15. Second gnathopod of male.
Fig. 16. First pereopod.
Fig. 17. Fifth pereopod.
Fig. 18. Side-view of urus, with uropoda and telson.
Fig. 19. First uropod.
Fig. 20. Second uropod.
Fig. 21. Third uropod of male.
Fig. 22. Distal portion of the same, more highly magnified.
Fig. 23. Third uropod of female.
Fig. 24. Telson.

XX.—*The Gribble* (*Limnoria lignorum*, Rathke) attacking a Submarine Cable in New Zealand. By CHAS. CHILTON, M.A., D.Sc., F.L.S., Professor of Biology, Canterbury College, New Zealand.

IN 1904 (Ann. & Mag. Nat. Hist. ser. 8, vol. xiii. p. 380) I recorded the presence in New Zealand of the gribble (*Limnoria lignorum*, Rathke), which had been found attacking submerged timbers in Auckland, Lyttelton, and Akaroa harbours. The species has also been found at Cape Town in South Africa, at Sydney in Australia, and at the Falkland Islands, and has probably been unintentionally introduced in most parts of the world.

In March 1916 Mr. Harold Hamilton, of the Dominion Museum, Wellington, forwarded to me a piece of the gutta-percha covering the inner core of the Cook Strait cable which had been burrowed into by some marine crustacean, together with three specimens of the animal. I found another still in the hole bored by it. On examining these, I found that they belonged to the species mentioned above, being distinguished from the indigenous New Zealand species *L. segnis*, Chilton, by the shape of the exopod of the maxillipeds and by the possession of a fairly well developed three-jointed palp to the mandibles. On further inquiry, I ascertained from Mr. Shrimpton, of the Telegraph Department, that the piece of cable examined came from a spot where a failure had occurred off Sinclair Head in Cook Strait at a depth of about 60 fathoms. The perforations that caused the sea-water to reach the inner core of the cable existed at a spot where a splice had been made. At other parts the armouring-wire of the cable prevents the animal from penetrating to the inner core. This inner core was covered with a thin sheet of gutta-percha, and it was through this that the gribble was burrowing.

While it is not astonishing that the gribble should be abundant in submerged timbers in harbours all over the world, having doubtless been introduced by old wooden ships, it is, perhaps, worthy of record that they have become so abundant that they attack the submarine cable at a depth of about 60 fathoms and at a distance of 13·75 nautical miles from the entrance to Wellington Harbour and of 4·75 nautical miles from the nearest land, Sinclair Head. It must be remembered also that in *Limnoria lignorum*, as in most Isopods, the eggs are carried in the incubatory pouch under the body of the female until the young are hatched almost in the adult form, and that the animal is small and from its structure would not be expected to have much power of locomotion.

XXI.—*New Indo-Malayan Lepidoptera.*
By Colonel C. SWINHOE, M.A., F.L.S., &c.

Family *Lycænidæ*.

Jamides gamblea, nov.

♂. Fore wing of the same bright pale blue colour as in *alenas*, Felder, and *hylassus*, Herbst, the central white band, which is clean-cut and prominent in both those species, only very faintly indicated; costal and outer marginal line and cilia black: hind wing with the basal two-thirds of the wing pure white, outer third of the same blue colour as in the fore wing, this colour not extending to the anal angle, which is white; a small blue space at the base of the wing, outer marginal line outside the blue space, and the cilia black. Underside: markings pale chocolate-brown: fore wing with the costal space very broadly and the outer margin narrowly brown, the rest of the wing white; three transverse, short, sinuous white lines across the brown colour near the apex, a marginal white line, and a submarginal white lunular line: hind wing with the brown colour of the fore wing continued across the base; wing white, outer marginal third brown, marginal line white; a series of large black lunules lined all round with white, one in each interspace—the first at the anal angle small, the next larger, the third the largest, the others gradually smaller in size; a double row of fine, sinuous, short white lines within the brown space above them. Body above blue, beneath it is white; the legs are white and the antennæ chocolate-brown broadly ringed with white.

♀. Forewing: upperside with costal and outer marginal space broadly and uniformly black, some blue-grey scales in the black space near the base: hind wing with the outer half black, some blue-grey scales at the base; the rest of both wings white. Underside much as in the male, the brown colour darker, the white median space somewhat narrower; the black lunular submarginal marks of the hind wing larger, with four or five brilliant blue streaks outwards.

Expanse of wings, ♂ ♀, $1\frac{6}{10}$ inch.

Hab. Ceram Island; Kaye Island, close to Ceram.

Catochrysops strabo-binna, nov.

♂. Uniformly smaller than *C. strabo*, Fabricius, the type of which Aurivillius says * is identical with the Ceylon form

* Ent. Tidsk. 1897, p. 148. no. 55.

figured by Moore in Lep. of Ceylon, i. pl. xxvii. fig. 2. Upperside with the colour dark greyish blue, darker and different in shade of colour, the marginal line on both wings deeper. Underside similar to *strabo*.

Expanse of wings, ♂, $1\frac{1}{10}$ inch.

Hab. Amboina.

Described from four males in my collection.

Catochrysops strabo-insularis.

♂. Upperside pale cærulean-blue, marginal line on both wings very finely black; an anteciliary fine white thread, nearly obsolescent on the fore wings; cilia white, with blackish bars on the hind wing; a black marginal spot in the first anal interspace.

♀. Upperside paler. Fore wing with a broad blackish costal band, widening gradually from the base, and narrowing hindwards on the outer margin; two or three indistinct submarginal brown spots near the hinder angle. Hind wing similarly coloured, the costal space with a little darker shade; a double row of white lunular submarginal marks, with brownish spots attached outside the outer row; a black anal spot ringed with pale orange.

The underside of both sexes as in *strabo*.

Expanse of wings, ♂ 1, ♀ $\frac{9}{10}$ inch.

Hab. Banda Island.

Described from eight males and one female in my collection; the smallest *strabo* form I have yet seen.

Euaspa bandana, nov.

♂ ♀. A smaller insect than *E. milionia*, Hewitson, but of much the same shade of colour. Fore wing with a broad costal and marginal blackish band, widening from the base to the apex, and extending evenly down the outer margin; the rest of the wing white, with its basal half suffused with cærulean-blue. Hind wing blackish, with a large white patch in the upper disc and some blue suffusion at the base. Underside greyish rufous, both wings crossed by a broad white band not quite reaching the costa of the fore wing, the basal portion with some white irregular markings, the outer portion of darker lunular spots ringed with white; a small black spot at the anal angle of the hind wing, and larger one next to it on the margin capped with orange.

Expanse of wings, ♂ ♀, 1 inch.

Hab. Banda Island, S. Moluccas.

Bullis buto.

Britomartis buto, de Nicéville, Journ. Bomb. N. H. Soc. 1895, p. 308, pl. P, fig. 41, ♂ (♀ ex errore).

Bullis buto, de Nicéville, Journ. As. Soc. Bengal, 1897, p. 559; Swinhoe, Lep. Indica, ix. p. 90, pl. 722. figs. 3, 3a, ♂ (1911).

♀. Upperside: fore wing dark bluish grey, with very broad blackish band, as in the male, but not nearly so deeply black, and somewhat broader than it is in the male: hind wing also similarly dark bluish grey, the marginal band blackish, broad on the costa, broadest at the apex and about half the breadth on the outer margin; tails black, tipped with white; both wings with the cilia black; an anteciliary pale fine line on the hind wing. Underside uniform ochreous grey; an ochreous-red somewhat sinuous discal line, edged with white as in the male; a subterminal row of lunular marks rather darker than the ground-colour, outwardly edged with white, more pronounced on the hind wing; some blue-grey scales at the anal angle in the first four interspaces; a large black anal spot, a smaller one in the third interspace ringed with orange; terminal line dark brown, with an inner white thread; antennæ black ringed with white, club with an orange tip.

Expanse of wings $1\frac{1}{10}$ inch.

Hab. Khasia Hills.

One example received from my native collector. The female seems to be very rare; I have received many males from the same collector.

Tajuria drucei.

Tajuria drucei, Swinhoe, Lep. Indica, ix. p. 107, pl. 728. figs. 4, 4a, ♂ (1911).

♀. Upperside with the markings much as in *T. cippus*, Fabricius, but the marginal black band narrower and the colour of both wings paler and more blue; the underside is similar to that of the male, but the transverse lines are somewhat more distinct.

Expanse of wings, ♀, $1\frac{3}{10}$ – $1\frac{4}{10}$ inch.

Hab. Haipau, Shan States.

I have lately received one male and two females.

Zizera aruensis, nov.

♂. Upperside dark greyish blue, with the margins of both wings broadly darker, all the black veins visible; cilia white, with brown bands. Underside grey, markings

chestnut-brown, edged with white. Fore wing with a lunular mark at the end of the cell; a postdiscal row of linear marks, one in each interspace, becoming obsolescent towards the costa; a submarginal similar row, thicker and mostly connected with each other, the space between them whitish; a marginal row of short thick lunules, ringed with white: hind wing with a lunular mark at the end of the cell; a sub-basal spot below the costa, another below on the inner side of the discoidal lunule, a spot near the costa beyond its middle, another below it in a line with the upper end of the discoidal lunule; a discal row of spots, its upper portion curved outwards to near the margin, then inwards in a line to the middle of the abdominal margin, the spot in the second interspace more inwards than the others; a double row of lunules near the outer margin, the outer ones ringed with white; both wings with fine marginal black line; grey cilia, with a white basal thread.

♀. Upperside uniform blackish brown, with a slight purplish tinge, marginal line black. Underside as in the male.

Expanse of wings, ♂ $\frac{8}{10}$, ♀ $\frac{7}{10}$ inch.

Hab. Aru Island.

Described from a pair in my collection.

Family Lithosiidæ.

Scaptosyle luzonica, nov.

♂. Head, body, and legs black. Upperside of wings dark, bright yellow: fore wing with a narrow, black, transverse, upright band a little beyond the middle, bent outwards below the costa, then straight down to the hinder margin; this band limits a purplish-pink space which occupies the outer portion of the wing, the costal line along it black: hind wing with a black marginal band, thickest at the apex, narrowing hindwards, terminating at the end of vein 2; cilia of both wings black. Underside as on the upperside, but duller in colour, the black band on the fore wing much broader.

Expanse of wings, ♂, 1 inch.

Hab. Luzon, Philippines.

Described from two males in my collection.

Family Arctiidæ.

Diacrisia sumatrana.

Diacrisia sumatrana, ♂, Swinhoe, Ann. & Mag. Nat. Hist. (7) xvi. p. 143 (1905).

♀. Fore wing dull ochreous brown, paler than in the

male; the only markings visible are:—a black spot on the median vein at the base of vein 2; a very faint, sinuous, transverse discal line, and a series of submarginal blackish dots: hind wing paler, a spot at the end of the cell and a submarginal, macular, pale brown band. Underside uniformly pale ochreous brown; a submarginal, more or less macular, and somewhat indistinct brown band across both wings, and a spot at the end of the cell on the hind wing. Head and body above and below concolorous with the wings; legs similarly coloured.

Expanse of wings, ♀, $1\frac{6}{10}$ inch.

Hab. Sumatra.

I have one male from Sokaranda and many males and one female from Padang.

Family Deilemeridæ.

Deilemera ægrota.

Leptosoma ægrotum, ♀, Swinhoe, Cat. Het. Mus. Oxon. i. p. 45, pl. v. fig. 15 (1892).

♂. Paler than the female: fore wing with the white discal band much narrower and more irregular, the marginal spots almost obsolete: hind wing with the blackish-brown marginal band also much narrower and with the white spots in it also almost obsolete. Underside with the dark portions darker and uniformly blackish brown, the white band of the fore wing broader than it is on the upperside, the white submarginal spots larger and prominent.

Expanse of wings, ♂, $1\frac{7}{10}$ inch.

Hab. Mackay, Queensland.

Deilemera carissima.

Deilemera carissima, ♂, Swinhoe, Trans. Ent. Soc. 1891, p. 477, pl. xix. fig. 1.

♀. Similar to the male in colour and pattern, but different in shape, the hind wing being round and normal, with its outer margin not excavated before the anal angle.

Expanse of wings $2\frac{4}{10}$ inches.

Hab. Khasia Hills.

There are both sexes in my collection.

Deilemera tripunctaria.

Bombyx tripunctaria, Linnæus, Syst. Nat. i. p. 523 (1758).

Geometra tripunctaria, Cramer, Pap. Exot. i. pl. xxii. fig. E (1775).

Leptosoma annulatum, Boisduval, Voy. de 'l'Astrolabe,' Lép. p. 197, pl. v. fig. 9 (1832).

Nyctemera doubledayi, Walker, ii. p. 392 (1854).

Hab. New Zealand.

Linnaeus's type certainly never came from the East Indies. Aurivillius says (Ent. Tidsk. 1897, p. 163) Cramer's figure is typical; I examined the type in the Thunberg Museum at Upsala; it undoubtedly represents the common New Zealand species described as *annulatum* by Boisdual and *doubledayi* by Walker.

Deilemera atralba.

Nyctemera atralba, Hübner, Verz. Schmett. p. 178 (1818).

Nyctemera sumatrensis, Heylarts, Compt. Rend. Soc. Ent. Belg. xxix. p. xvii (1890); Pag. Jahrb. Nass. Ver. Naturk. 1901, p. 139, pl. ii. fig. 6.

Nyctemera tripunctaria, Walker (nec Linn.), ii. p. 397 (1854).

Hab. Malay Peninsula and Archipelago.

Deilemera nigrovena.

Deilemera nigrovena, ♀, Swinhoe, Trans. Ent. Soc. 1903, p. 74, pl. iv. fig. 2.

♂. Resembles the female, but the longitudinal bands on the thorax are broader, and, instead of being yellow with black stripes, it is black with thin yellow stripes; otherwise there is no difference.

Expanse of wings, ♂, $2\frac{1}{10}$ – $2\frac{2}{10}$ inches.

Hab. Samanga, South Celebes.

I have three males from that locality.

Family Lymantriidæ.

Gazalina intermixta.

Gazalina intermixta, Swinhoe, Ann. & Mag. Nat. Hist. (7) vi. p. 306 (1900).

♀. Wings pure white without any black on the veins: fore wing with a well-curved, subbasal, black thin band and two transverse, straight, thick black bands, well separated from each other, the inner one upright, crossing the cell before its middle, with a minute dent inwards below the upper margin of the cell, the outer one inwardly oblique from the costa one-fourth from the apex to the hinder margin, a little beyond the middle, with a corresponding minute outward dent: hind wing with an indistinct straight grey middle line from the costa one-fourth from the apex to the abdominal margin above the anal angle. Abdomen with a very large anal tuft of hairs, ochreous grey, with the outer half brown. Underside with a blackish transverse band beyond the middle across both wings.

Expanse of wings, ♀, 2 inches.

Hab. Jaintia Hills, Khasia Hills.

Sir George Hampson has sunk this very distinct form to *G. chrysolopha*, Kollar*, from which it is quite distinct; I have a fair series of each; the transverse bands of the fore wing in the males are not always the same distance apart from each other; one male has also the middle band on the hind wing, and all have the prominent black bands on the underside.

Leucoma ecomoda.

Leucoma ecomoda, ♂, Swinhoe, Ann. & Mag. Nat. Hist. (7) xx. p. 77 (1907).

♀. Differs considerably from the male; both wings hyaline except for the outer margins, with several short, thin, outwardly inclined transverse streaks of white scales, several on the basal half of the fore wing, and two or three on the hind wing; the discoidal vein also similarly scaled; an almost square, pale, chocolate-coloured patch on the middle of the hinder margin of the fore wing, and the costal line similarly coloured; both wings with a somewhat narrow pale chocolate outer band, its inner edge very irregular and curved and bent in many places; a streak from it extending halfway up near the abdominal margin of the hind wing. Underside as above, but the white-scaled marks more prominent and on the hind wing more numerous. Head chocolate, collar white, thorax grey; abdomen greyish pink on the underside; the abdomen white in its middle; pectus white; legs pink.

Expanse of wings, ♀, $1\frac{8}{10}$ inch.

Hab. Java, Sumatra.

I have both sexes from Padang, W. Sumatra.

Euproctis lunifera.

Adhullia lunifera, Walker, xxxii. p. 392 (1865). ♀ (nec ♂); Swinhoe, Cat. Het. O. M. i. p. 184, pl. vi. fig. 3 (1892).

Euproctis discophora, Snellen, Tijd. voor Ent. xxii. p. 113, pl. ix. fig. 2 (1879). ♂.

Hab. Celebes. Type in Mus. Oxon.

Euproctis celebensis, nom. nov.

Adhullia signata, Walker, xxxii. p. 393 (1865) (præocc.).

Euproctis signata, Swinhoe, Cat. Het. Mus. Oxon. i. p. 185 (1892).

Hab. Menado, Celebes (Wallace). Type in Mus. Oxon.

* Journ. Bomb. N. H. Soc. xvi. (2) p. 199 (1905).

Signata præoccupied by Blanchard in Jacquemont, Voy. Inde, iv., Ins. p. 24, pl. i. fig. 7 (1844).

Euproctis moalata, nom. nov.

Euproctis divisa, Walker, Journ. Linn. Soc. vi. p. 129 (1862) (præocc.); Swinhoe, l. c. p. 186, pl. vi. fig. 14 (1892).

Hab. Sarawak, Borneo (Wallace). Type in Mus. Oxon.

Divisa præoccupied by Walker, vol. iv. p. 836 (1855).

Euproctis coccinata, nov.

♂. Above and beneath antennæ, head, body, legs, and wings of a nearly uniform scarlet-colour; on the upperside of the fore wings there are two or three very indistinct longitudinal streaks of grey scales, which make that wing look a shade darker than the hind wing; the abdomen is a little paler and has some whitish down its centre on the underside; otherwise the general colour is peculiarly uniform, without any markings.

Expanse of wings, ♂, $1\frac{4}{10}$ inch.

Hab. Hainan, China.

Dasychira postfusca.

Dasychira postfusca, ♂, Swinhoe, Trans. Ent. Soc. 1895, p. 9, pl. i. fig. 12.

♀. Wings whitish grey, covered sparsely with minute grey atoms: fore wing with very indistinct traces of the outer sinuous and recurved transverse line, and more distinct submarginal grey line with dentations similar to those in the male: hind wing with a patch of some dark greyish suffusion at the apex. Underside whitish, some grey suffusion at the base of fore wing and on the abdominal area of hind wing. Abdomen brown, whitish at the anal third and on the underside, where there are some brown segmental bands.

Expanse of wings, ♀, $2\frac{2}{10}$ inches.

Hab. Khasia Hills.

Both sexes from the Khasia Hills are in my collection.

Family Notodontidæ.

Ceira seacona, nov.

♂. Upperside: fore wing dark ochreous, irrorated with grey atoms, the irrorations collected together in places forming grey spots on the basal two-thirds of the wing; a discal row of more distinct spots, evenly outwardly curved from the

costa one-fourth from the apex to the middle of the hinder margin, the space beyond suffused with pale grey, containing a submarginal and a marginal row of similar spots: hind wing greyish ochreous, shading darker towards the outer margin. Head and thorax dark ochreous, abdomen greyish ochreous. Underside: body, legs, and wings whitish, without any markings.

Expanse of wings $2\frac{2}{10}$ inches.

Hab. Hainan.

Family Lasiocampidæ.

Metanastria sumatræ, nov.

♂. Antennæ dark greyish ochreous; palpi, head, thorax, and fore wing above dark brown, with a pinkish-red tinge; a minute white dot at the end of the cell, duplex transverse darker brown bands, ante- and postmedial outwardly curved below the costa, inwardly curved above the hinder margin; three minute submarginal white dots in the three uppermost interspaces, ringed with black, and two black dots, touched with white in the two next interspaces: hind wing paler, two faintly indicated outwardly curved discal bands. Underside: both wings uniformly coloured of a paler and duller pink-brown, and both wings crossed by two brown discal bands nearly straight and rather close to each other. Abdomen above and beneath and the thorax beneath and the legs pale pinkish brown; sides of the head and pectus dark brown.

♀. Upperside of a uniform pale brown colour, also with a pinkish-red tinge; bands on both wings similar to those in the male but narrower, the cell-spot and five submarginal spots of the fore wing present but very indistinct. Underside very slightly paler than the upperside, with the duplex discal band faintly indicated, the antemedial band obsolete; antennæ, palpi, head, body above and below, and the legs concolorous with the wings.

Expanse of wings, ♂ $3\frac{6}{10}$, ♀ $4\frac{8}{10}$ inches.

Hab. Padang, Sumatra.

Allied to *M. purpurascens*, Moore, from Borneo, which is also in my collection; that species has also indications of the dots on the fore wing, but the transverse bands are more numerous and are quite differently situated, and the colour is brown without the pinkish tinge.

Odonestis lucifuga.

Metanastria lucifuga, ♂, Swinhoe, Cat. Het. Mus. Oxon. i. p. 264, pl. vi. fig. 5 (1892).

Odonestis malayica, ♂ ♀, Swinhoe, Ann. & Mag. Nat. Hist. (8) xvi. p. 178 (1916).

Hab. Singapore, Sarawak, Borneo, Celebes.

The mistake was quite natural ; on looking over the B. M. collection I found three forms of *plagifera*, Walker, over that name, and quite forgot that twenty-four years ago I had described the male of one of them.

Family Noctuidæ.

Aramuna padanga, nov.

♂. Fore wing ochreous brown, indications of an inner transverse line ; a medial rather broad and erect brownish band, bent inwards below the costa ; a postmedial black line, much curved outwards and inwards, and indications of a brown patch on the costa close to the apex : hind wing pale greyish brown, without markings. Underside : fore wing dark brown, the apical and outer marginal space paler, the hinder margin broadly whitish. Head and body above and below and the legs concolorous with the wings.

Expanse of wings, ♂, 1 inch.

Hab. Padang, Sumatra.

Genus *BOCULA*, Guenée.

Bocula, Guenée, Noct. iii. p. 295 (1852).

Borsippa, Walker, xv. p. 1756 (1858).

Bocula poaphiloides.

Thermesia poaphiloides, Walker, Journ. Linn. Soc. vii. p. 186 (1864).

Dyrzela poaphiloides, Swinhoe, Cat. Het. Mus. Oxon. ii. p. 42, pl. i. fig. 7 (1900).

Hab. Sarawak, Borneo ; Padang, Sumatra.

My specimen seems to be identical with my figure of Walker's type in Mus. Oxon. It is very difficult to place the different species of this group, whether they come into the section *Bocula* or *Aramuna*, divided by male characters only. The males of the group are exceedingly rare ; in the eleven species in my collection there are only two males, and the types of nearly all are females ; therefore all these species must, until their males are found, be confined to the genus *Bocula*.

Bocula punctilinea.

Borsippa punctilinea, Hampson, Ill. Het. viii. p. 83, pl. cxlvi. fig. 14, ♀ (1891).

Hab. Nilgiri Hills (type).

I have specimens from Port Blair and Cherra Punji which seem to me identical with the Nilgiri type, all females.

Bocula celebensis, nov.

♀. Upperside: fore wing pinkish grey; faint indications of three transverse sinuous lines—antemedial, medial, and postmedial; three pale points on costa near apex; a submarginal sinuous line with three brownish patches on its outer side near apex, next to it and on the hinder margin, the first two more or less conjoined; a black dot at the end of the cell, another opposite it, on the submarginal line; a series of marginal black dots: hind wing blackish brown without markings. Underside: fore wing brown unmarked; hind wing with outer half brown, inner half grey; a black dot at the end of the cell of each wing. Head and body above and below and the legs concolorous with the wings.

Expanse of wings, ♀, 1 inch.

Hab. Celebes (*Doherty*).

Bocula sambawana, nov.

♀. Upperside: fore wing pinkish fawn-colour, markings brown; a subbasal dot, one in the cell, and a ring constricted in its middle at the end; antemedial and medial outwardly curved line, neither reaching the hinder margin, but connected together by a line excavated near the inner line; a discal line, acutely angled outwards, against a broken subapical patch, then straight and inwardly oblique to the hinder margin; a marginal line and brown cilia, with a pale ochreous base: hind wing greyish brown without markings; cilia as on fore wing. Underside pale greyish brown; a discal outwardly curved line across the fore wing. Palpi white beneath, body and legs streaked with white.

Expanse of wings, ♀, 1 inch.

Hab. Sambawa Island (*Doherty*).

Family Geometridæ.

Opthalmodes pulsaria.

Opthalmodes pulsaria, ♂, Swinhoe, Trans. Ent. Soc. 1891, p. 489.

♀. Wings of a greenish-grey colour, all the markings as in the male.

Expanse of wings, ♀, $2\frac{7}{10}$ inches.

Hab. Khasia Hills.

Opthalmodes lectularia.

Opthalmodes lectularia, ♂, Swinhoe, l. c. pl. xix. fig. 4.

♀. A smaller insect than *pulsaria*; sexes alike.

Expanse of wings, ♀, $2\frac{4}{10}$ inches.

Hab. Khasia Hills.

Hampson, in 'Moths of India,' iii. p. 255, has put both these perfectly distinct forms as synonyms to *O. herbidaria*, Guenée, to which they have hardly a superficial resemblance; *pulsaria*, of which I have received many males and one female from the Khasia Hills, is very common there; of *lectularia* I have two males and two females in my collection, the colour and pattern of each very uniform; I have seen no variation in any specimen yet received; *herbidaria*, Guenée, *diurnaria*, Guenée, and *pulsaria* and *lectularia*, mihi, are all good forms, perfectly distinct from each other; I have a fine series of the first three.

Dalima gigantea.

Dalima gigantea, ♀, Swinhoe, Ann. & Mag. Nat. Hist. (6) xix. p. 166 (1897).

♂. Smaller and darker than the female; the hind wing suffused almost all over with dull ochreous red; the fore wing is not so acute at the apex and the antennæ long (quite two-thirds the length of the costa of fore wing), serrate, with fasciculated cilia for two-thirds of its length; the markings are as in the female.

Expanse of wings, ♂, $3\frac{6}{10}$ inches.

Hab. Jaintia Hills.

I have both sexes of this rare species; it is nearer in structure to *Dalima apicata*, Moore, than to the subgenus *Panisala*, Moore; the excavation below the apex of the fore wing and the length and peculiar stiff wire-like serrations of two-thirds of the antennæ do not quite bring it into any of the sections of the genus *Dalima* as worked out in Hampson's 'Moths of India,' iii. p. 237. I have put it in my collection between *Panisala* and *Dalima*.

Dilophodes khasiana.

Abraxas khasiana, ♂, Swinhoe, Trans. Ent. Soc. 1892, p. 17.

Dilophodes elegans, Hampson (nec Butler), Moths of India, iii. p. 305 (1895).

♀. Fore wing like the male, the black spots somewhat larger: hind wing with the spots in the marginal space larger; the middle submarginal spots joined to the marginal spot, forming a large blotch of four conjoined spots; a large apical spot.

Expanse of wings, ♀, 2 inches.

Hab. Khasia Hills.

In 'Moths of India' this is made a synonym of Butler's species, thus bringing the Japanese species into the fauna of British India. I have both sexes of *khassiana* and two males of *elegans* from Yokohama and Oiyama. The Khasia Hills form has all the spots more or less disconnected, but in the Japanese form they are all more or less connected together; and it seems to me to be incorrect to lump together two forms from such widely different localities, where the two forms differ more or less in pattern.

Vithora nigripars.

Halthia nigripars, Swinhoe, Trans. Ent. Soc. 1892, p. 16, pl. i. fig. 1. ♂.

♀. Like the male: fore wing with the basal white marks almost obsolete; the two large square white spots at the end of and below the middle of the cell larger, as are also all the white spots on the hind wings.

Expanse of wings $2\frac{5}{16}$ inches.

Hab. Khasia Hills, Jaintia Hills.

Family Pyralidæ.

Genus TELESPASTA, Swinhoe.

Telespasta, Swinhoe, Ann. & Mag. Nat. Hist. (7) xvii. p. 294 (1906).

Telespasta cuprealis.

Pygospila cuprealis, Swinhoe, Trans. Ent. Soc. 1892, p. 19, pl. i. fig. 4. ♂.

Pygospila evanidalis, Snellen, Tijds. voor Ent., June 1896, p. 14, pl. vi. figs. 4, 4 a. ♀.

Hab. Khasia Hills.

Sisyrophora elwesialis.

Cydalmia elwesialis, Snellen, Trans. Ent. Soc. 1890, p. 607, pl. xix. figs. 1, 1 a.

Glyphodes pfeifferæ, var., Kenrick, P. Z. S. 1912, p. 554, pl. lxviii. fig. 21.

Hab. Sumatra; Dutch New Guinea.

XXII.—On the *Hyoidean Apparatus of the Lion* (*F. leo*) and *Related Species of Felidæ*. By R. I. POCKOCK, F.R.S., Superintendent of the Zoological Society's Gardens*.

IN typical members of the *Felidæ* the suspensorium (fig. 2, A), or anterior cornu, of the hyoid consists of four elements—the ceratohyal, epihyal and stylohyal (which are ossified in the adult), and the tympanohyal (which generally, if not always, remains cartilaginous through life up to its point of attachment with the bulla) †. But it is well known that the hyoid apparatus of some of the larger species of *Felidæ*—*F. leo* and *F. tigris*, for example—differs from that of the majority of species in the defective ossification of parts of the suspensorium, so that the larynx, clamped though it be by the basihyal and thyrohyals, is not held close up to the base of the skull by a comparatively short series of contiguous and jointed bones, but is imbedded in the muscles of the throat, and is susceptible of much greater range of movement than is ordinarily the case. The missing portion of the suspensorium is represented by a long and slender "ligament," the course of which it is by no means always easy to follow through the muscles it traverses.

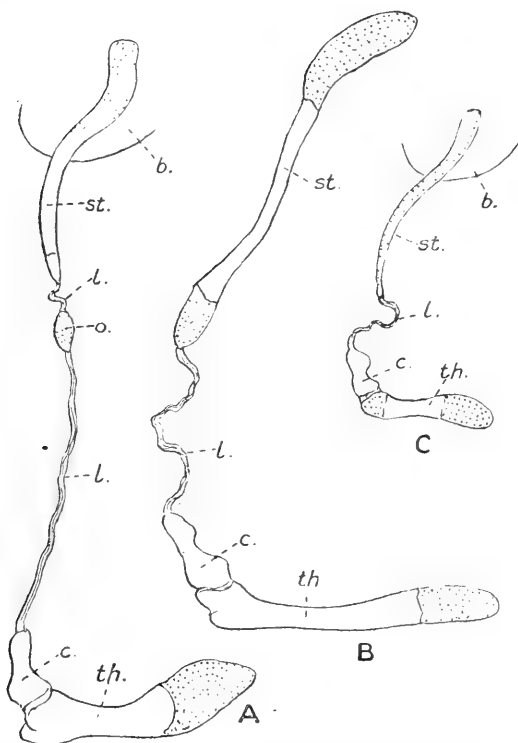
Blainville's figures (*Ostéogr. Atlas, Felis*, pl. xi.) of the hyoid in *F. leo*, *F. tigris*, and *F. pardus*, the only species known up to the present time to possess the modification of the suspensorium above described, show that the lower end of the suspensorium is represented by the ceratohyal and the upper by a styloid process which is undivided in *F. pardus*, but divided into a proximal cartilaginous portion, and a distal osseous portion in *F. leo* and *F. tigris*. The ligament, moreover, carries one bead-like ossicle in *F. leo* and *F. pardus* and two in *F. tigris*. Thus, the suspensorium in the lion, tiger, and leopard consists of two main bones instead of three, the ligament with the ossicles taking the place of the epihyal. But, according to Blainville (*Ostéogr.* vol. ii., *Felis*, p. 32),

* The facts recorded in this paper are based upon dissections made in the Society's Prosectorium.

† Flower applied the term "tympanohyal" to the ossicle of the hyoid which is embedded in the styloid foramen of the skull. Mivart ('The Cat,' pp. 77-78) extended the term to include the longish cartilage depending from that bone. In this paper, without prejudice, I follow Mivart's terminology, leaving open the question as to whether or not this cartilage is a separate element from the tympanohyal. It may belong to the stylohyal. At all events, before ossification of the latter sets in, it appears to form with the tympanohyal a continuous cartilaginous rod, which, for convenience, I speak of as the styloid process.

the suspensorium in the jaguar (*F. onca*), which on *à priori* grounds might be expected to resemble that of the leopard, is like the suspensorium of typical cats in consisting of three

Fig. 1.



A. Lateral view of hyoid apparatus of a young lion (*Felis leo*). *st.*, styloid process; *l.*, ligament with sesamoid cartilage (*o.*); *c.*, ceratohyal; *th.*, thyrohyal; *b.*, portion of bulla in profile.

B. The same of adult tiger (*Felis tigris*). Lettering as in A.

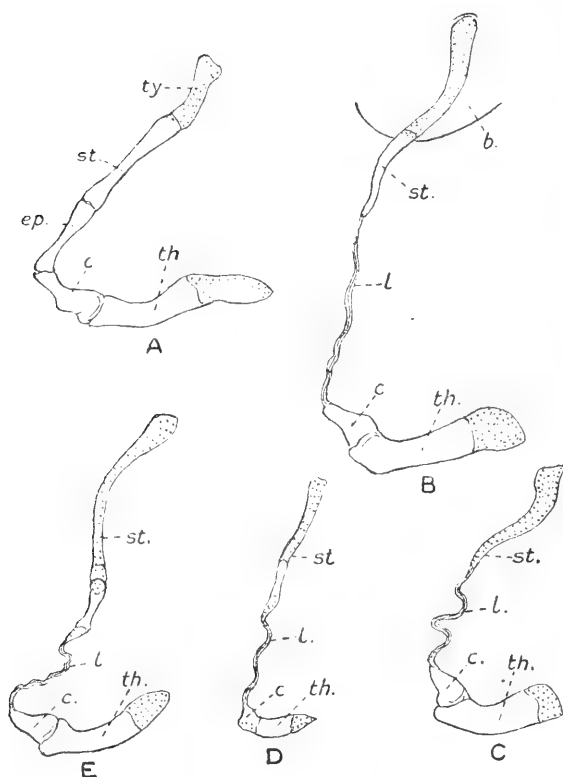
C. The same of immature ounce or snow-leopard (*F. uncia*). Lettering as in A and B.

Fig. A is approximately natural size; figs. B and C are two-thirds natural size. Cartilaginous elements are dotted. The ligaments are not represented their natural length, but shortened and twisted by the action of alcohol.

bones joined end to end, without the intervention of a ligament. It will be noticed, however, that his figure of the hyoid of this species, although agreeing with the text in

indicating three distinct bones, shows the second bone from the top joined to the inferior bone by a dotted line. I

Fig. 2.



- A. Lateral view of hyoid of hunting leopard (*Acinonyx jubatus*), showing the structure of this apparatus in normal species of Felidæ. *ty.*, tympanohyal cartilage; *st.*, stylohyal; *ep.*, epihyal; *c.*, ceratohyal; *th.*, thyrohyal.
- B. The same of the adult common leopard (*Felis pardus*). Lettering as in fig. 1, A.
- C. The same in immature leopard (*Felis pardus*). Lettering as in fig. 1, A.
- D. The same in very young jaguar (*Felis onca*). Lettering as in fig. 1, A.
- E. The same of one-year-old jaguar (*Felis onca*). Lettering as in fig. 1, A.

All two-thirds natural size. Ligament and cartilages represented as in fig. 1.

supposed at one time, as probably others have done before, that the elements of the suspensorium in this case were

separated on the plate, so as to be fitted into it, although there was no very obvious reason for selecting this particular figure to be treated in that way. But I now believe that in the preparation from which the figure in question was taken the hyoid at the point indicated was divided by the interposition of a ligament which was lost in maceration; and, secondly, that Blainville's assertion that the two bones were connected was nothing but an inference based upon the assumption that when the ligament is present the suspensorium contains only two bones, and that when the suspensorium is composed of three bones the ligament is absent.

The reasons given above for the opinion that Blainville's interpretation of the hyoid of *F. onca* was erroneous is supported by the presence of the ligament in two examples of this bone that I possess. In one, taken from a young cub (fig. 2, D), there is a long cartilaginous styloid process, broad above and tapering below, with a single cylindrical ossification in its lower half a little less than its own length from the cartilaginous inferior extremity. From this extremity a longish ligament passes to the summit of the ceratohyal. In this example the hyoid is rather smaller than that of a domestic cat (*F. catus*). In a second, much larger example of the hyoid taken from a jaguar about one year old (fig. 2, E) the styloid process is divided into two distinct portions—an upper, long, and somewhat curved cartilaginous piece and a lower piece, consisting of a slender cylindrical bone with a cartilaginous epiphysis at each end. From the short inferior epiphysis the ligament runs to the ceratohyal.

The correspondence between the elements of the two hyoids just described is quite clear from the figures (fig. 2, D, E); and if the figure of the more advanced of the two be compared with that of the adult hyoid of *F. onca* depicted by Blainville, it will, I think, be evident that the two long bones constituting the upper end of the suspensorium in the adult are the homologues of the long cartilaginous element and the shorter bony element in the one-year-old example above described, the only difference being that the upper portion of the suspensorium is ossified in the adult and cartilaginous in the young.

In a very young leopard (fig. 2, C) I find that the suspensorium consists of a long, cartilaginous, curved, styloid process, broad at the top and tapering at the point, a longish ligament, and a short weakly ossified ceratohyal. In a full-grown example (fig. 2, B) it is composed of the same elements, but the inferior half of the styloid is ossified, its superior, broader, and more flattened half remaining cartilaginous. It

is noticeable that the ligament is distinctly longer in this species than in the jaguar, but in the examples examined there is no trace of the oval sesamoid bone on the ligament depicted by Blainville.

In an adult tiger (fig. 1, B) the suspensorium broadly resembles that of the leopard, except that the broad upper cartilaginous portion of the styloid bar is only about half the length of the slender ossified portion and the latter has a cartilaginous epiphysis at its lower extremity. From this a long ligament, without oval ossification, passes to the summit of the ceratohyal. Except for the absence of the ossicles on the ligament and its longer styloid, this suspensorium tolerably closely resembles that of the same species figured by Blainville.

In the hyoid of a young lion (fig. 1, A) I find a long partly cartilaginous styloid, with a distinct cartilaginous epiphysis at its lower end, and long ligament passing to the ceratohyal, and furnished near its upper end close to the tip of the styloid with an oval cartilage.

Finally, in a young ounce (*F. uncia*) the suspensorium is composed of a long, tapering, cartilaginous, styloid process, a comparatively short ligament, and the ceratohyal. The structure of the hyoid in this species has not been previously described (fig. 1, C).

Comparison between the hyoids of an adult leopard (*F. pardus*), tiger (*F. tigris*), and cheetah (*A. jubatus*) suggests that the cartilaginous tympanohyal and the ossified stylohyal in the last are represented by the partly cartilaginous and partly ossified proximal end of the suspensorium in the other two; and since the ceratohyal is the distal end of the suspensorium in the three forms, it seems obvious that the epihyal of the cheetah is the part that is missing in the tiger and leopard, its place being taken by the elastic ligament.

But in the case of the jaguar (*F. onca*) this is not so clear. In the adult of this species, according to Blainville, the upper end of the suspensorium consists of two mutually jointed bones, the proximal of which is long and slender. In the young animal a year old (fig. 2, E) the upper bone is represented by a cartilage correspondingly long, and forms a definite joint with the cartilaginous upper epiphysis of the partially ossified lower element, and is at the same time more sharply separated from the lower bony element than is the proximal cartilage of the suspensorium, the tympanohyal cartilage, from the bony stylohyoid element in the cheetah,

leopard, and tiger. The great length, indeed, of the upper cartilaginous element in the young jaguar and its mode of articulation with the second bony element suggest that it is the homologue of the partly cartilaginous, partly ossified upper element—that is to say, of the tympanohyal cartilage and of the stylohyoid bone—in the cheetah, leopard, and tiger. In that case, the second element in the jaguar corresponds to the epihyal of the cheetah, and the comparatively short ligament is interposed between the epihyal and the ceratohyal, and does not replace the epihyal.

From the data available it does not appear to me that this point can be settled; but I incline to the opinion that that interpretation is correct, and that Blainville, although wrong in stating that the ligament is absent in the jaguar, was right in saying that the suspensorium in that animal consists of the same bony elements—namely, the stylohyal, epihyal, and ceratohyal—as in the normally constructed hyoids of Felidæ. If this be so of the five species—namely, the lion, tiger, leopard, ounce, and jaguar—which have an elastic ligament in the hyoidean suspensorium, the jaguar is the most primitive in retaining the three bony suspensorial elements in the hyoid, and at the same time shows the first step in the modification of the hyoid to have been the interposition of an elongated elastic ligament between the ceratohyal and the epihyal, and the second step, as illustrated in the leopard, lion, and tiger, to have been the suppression of the epihyal element. The obvious suggestion here arises that the bony nodule, or nodules, sometimes present near the upper end of the ligament in these three species may be the remnant of the epihyal.

Whichever of the two above-suggested interpretations proves ultimately to be correct, the important fact remains that in the lion, tiger, leopard, ounce, and jaguar there is a longish or very long elastic ligament interposed between the ceratohyal and the upper element of the hyoidean suspensorium.

All the other species of the Felidæ that I have examined, including *F. concolor*, *pardalis*, *wiedii*, *geoffroyi*, *jaguarondi*, *pajeros*, *nebulosa*, *viverrina*, *bengalensis*, *serval*, *aurata*, *chaus*, *ocreata*, *nigripes*, *sylvestris*, *caracal*, *lynx*, *rufa*, and *Acinonyx* (*Cynælurus*) *jubatus*, bear out the observations of others, that there is no long elastic ligament in the suspensorium in any form but the five enumerated above.

In his paper on the anatomy of the cheetah (*Acinonyx jubatus*) Owen (Tr. Zool. Soc. i. p. 129, 1834) wrote as follows:—"In their internal structure the differences of the

Felis one from another are less easily appreciable than in their outward form. Perhaps the most marked among the anatomical variations obtains in the mode of attachment of the *os hyoides* to the cranium; and this difference is evinced in the living animal by a difference in the variety and power of the voice. In the lion an elastic ligament, about 6 inches in length, connects on each side the lesser cornu [ceratohyal] of the *os hyoides* with the styloid process; this ligament can be stretched to 8 or 9 inches. The larynx is consequently situated at a considerable distance from the posterior margin of the bony palate; but the soft palate is prolonged backwards to opposite the aperture of the glottis, and the tongue is proportionately increased in length. Thus a gradually expanding passage leads from the glottis, where the air is rendered sonorous, to the mouth, and it is not unlikely that the strong transverse ridges upon the bony palate may contribute, with the preceding trumpet-like structure, to give that intonation which is so aptly denominated 'the roar of the lion.'

"In the domestic Cat, in *Felis planiceps*, and in *Felis caracal* the *os hyoides* is connected with the cranium by an uninterrupted chain of bones The same structure obtains in the Cheetah. From the difference in the voice, the feline animals might have been expected, *à priori*, to present some differences in that part of their anatomy which relates to it."

In this passage Owen was, I believe, the first to point out the connection between the resonance of the voice and the looseness of the hyoid in the lion. The same applies to the tiger, the roar of which, used solely, I believe, as a sexual call, is deceptively like that of the lion at times. On the other hand, the roars of the jaguar and leopard are quite different from those of the lion and tiger, but remarkably like one another. It is not easy to describe them, but I have elsewhere (P. Z. S. 1907, p. 677) compared the sound to "a series of hoarse barking coughs, an interval of about one second separating each expiratory effort. It very much resembles the sound produced by sawing a piece of thin wood with a coarse-toothed saw" *. The voice of the ounce is unknown to me. The only sound I have heard these animals make results from puffing through the nostrils. The tiger has a similar habit when pleased. The voice of other members of the *Felidæ* cannot be described as a roar. The

* The name "jaguar" is, I presume, derived from the roar of the animal, of which it is not a bad representation.

call of the cheetah is a most decided mew, hardly distinguishable from that of domestic cats.

Apart from the roar there is another very distinctive feature about the voice of the cats with a normal hyoid. This is the familiar "purr." Lions, tigers, leopards, and jaguars never purr; on the other hand, such widely different species as cheetahs, pumas, caracals, jaguarondis, and others that could be named, always, when sufficiently tamed, express pleasure or content by that sound. These are interesting differences correlated with the differences in the hyoidean apparatus above described.

CONCLUSION.

The following are the main points this paper seeks to establish:—

1. The hyoid of the jaguar (*Felis onca*) resembles that of the lion (*F. leo*), tiger (*F. tigris*), and leopard (*F. pardus*) in having the suspensorium lengthened by an elastic ligament interposed between the ceratohyal and the upper elements of the suspensorium. Blainville, therefore, was wrong in denying the existence of the ligament in the jaguar.
2. The hyoid in the ounce (*F. uncia*) resembles that of the above-mentioned species.
3. The species in which the hyoid is provided with this ligament roar, but do not purr. All the other species of Felidæ with normally constructed hyoid purr, but never roar.

XXIII.—*Triæschna gossi*, a new Genus and Species of Odonata from the Eocene of Bournemouth. By HERBERT CAMPION.

[Plate XI.]

IN the 'Entomologist' for 1878 (vol. xi. p. 193) H. Goss figured the right fore-wing of a fossil *Æschnid* dragonfly, and made some general remarks concerning it. The specimen was in a very fine state of preservation, and was obtained by J. Starkie Gardner from the leaf-beds (Bagshot Sands) of Bournemouth, Hampshire. It was referred to the genus *Æschna*, but no specific name was proposed, no measurements of the wing were stated, and no description of the venation was given.

The figure was noticed by Scudder in 1890 ('Tertiary Ins. N. Amer.' pp. 142, 144), who remarked that "it appears to belong to the subgenus *Basiaeschna*, but, as it is certainly incorrectly drawn in some particulars, it may be in those, such as the simplicity of the subnodal sector [*i. e.*, the radial sector], upon which this suggestion is based."

Goss's figure is certainly not a good one, but it evidently represents a fossil purchased from J. S. Gardner in 1892, and now preserved in the British Museum (Natural History). This is likewise a right fore-wing, in almost perfect preservation, from the Bagshot Beds of Bournemouth. With it is placed the counterpart of the basal half of the fossil, which, unlike the main slab, shows the extreme base of the wing.

For facilities for studying this beautiful fossil, which I now proceed to describe, I am indebted to the kindness of the Keeper of Geology, British Museum. I am also under obligation to Dr. F. Ris, of Rheinau, Switzerland, for valuable suggestions respecting relationships with recent genera.

Triaschna gossi, gen. et sp. n. (Pl. XI.)

Right fore-wing:—*Narrow**, entirely hyaline. Apex acute. Length about 64 mm. Width at its broadest part 13 mm. Costa strongly arched above the region of the triangle. *Nodus almost exactly at the middle of the wing.* Distance between nodus and proximal end of pterostigma 20 mm. The antenodal cross-veins very numerous, as many as thirty-three being visible; the usual two hypertrophied antenodals cannot be detected. Twenty visible postnodals. *Pterostigma dark brown, broad, 5 mm. long, covering several cells; brace-vein rather slender, very oblique, the anterior end not meeting exactly the proximal limit of the pterostigma. Subcosta not produced beyond the nodus. No cross-veins in the median space.* Arculus at the level of the third antenodal, moderately angulated; the branches of the media arising very close together at about the middle. *M₁ slightly waved posteriorly before the level of the pterostigma. M_{1a} arising well beyond the level of the middle of the pterostigma. M₂ arching gently upwards just before the pterostigma, and thereafter taking a markedly downward course. Oblique vein not recognizable. Rs bifurcating conspicuously (about 8 cells) before the level of the proximal end of the pterostigma, and not arching anteriorly; fork almost symmetrical; one row of cells between the upper branch and M₂, and four rows of cells within the fork at the widest part. R. suppl. well developed,*

* The principal diagnostic characters are printed in italics.

hardly at all curved or waved, and separated from Rs at the widest interval by three rows of cells. M_3 reaching the hind margin of the wing at about the level of the bifurcation of Rs. M_4 not bent away abruptly from M_3 beyond the level of the nodus, but curving away from it gently, so as to admit two rows of cells from the level of the proximal end of R. suppl. to the hind margin of the wing. At least seven cross-veins in the supertriangle. Subtriangle traversed by a single cross-vein. Five other cubito-anal cross-veins, amongst which the anal crossing is not discernible. Triangle very long, narrow, its base comparatively broad and bowed towards the interior of the enclosure, its long axis directed outwards and not at all forwards, containing seven cells, two of which surmount a single large cell at the base. Trig. suppl. long and well developed, gently curved, its proximal end resting upon the triangle only a very little below the outer corner, its distal end reaching about as far as the proximal end of M. suppl., from which it is separated by one row of cells. M. suppl. with a slight double curve; beginning as a well-defined vein soon after the level of the proximal end of the bridge; separated from M_4 at first by two rows of cells, under the nodus by three rows, and towards the margin of the wing by two rows of small cells. Space between Cu_1 and Cu_2 moderately dilated at the base, and with a single row of cells. Cu_1 reaching the hind margin of the wing a little beyond the level of the nodus. Cu_2 separating quite near to the lower corner of the triangle, and continuing as a distinctly marked vein about as far as the level of the nodus. The cells between this vein and the hind margin of the wing numerous, and arranged for the most part in oblique rows, thus giving to Cu_2 an appearance of branching. The usual two rows of cells between the anal vein and the hind margin of the wing; twelve cells in the upper row. The membranule not preserved.

Type of the genus and species the above-mentioned fossil and its counterpart in the British Museum (Natural History), Geol. Dept., reg. no. I. 2595.

There are several other fossil dragonflies with which *Triceschna gossi* may be usefully compared. The oldest of these appears to carry the history of the *Æschninae* well back into Mesozoic times, for a figure of *Morbæschna muensteri*, Germar, published by Prof. James G. Needham (Bull. Amer. Mus. Nat. Hist. xxiii. p. 142, 1907), shows a venation comparable with that of the North-American *Æschninae Gomphæschna furcillata*, Say, and evidently coming within the same subfamily. The history of this fossil is not given, but the

species was originally described from the Lithographic Stone of Bavaria. Another record from the Kimmeridgian which may, perhaps, be mentioned here is that of a very small nymph from North-eastern Spain, described by Meunier under the name of *Palææschna viduli* (Mem. Acad. Barcelona, xi. no. 9, p. 122, pl. ii., 1914).

Eleven species of the subfamily from the Tertiary of Europe and North America were enumerated by Handlirsch in 1907 ('Die Fossilen Insekten,' pp. 900-901). Four of them—*Æschna larvata*, Scudder, *Æ. dido*, Hagen, *Æ. eudore*, Heer, and *Æschna* sp., Curtis—were described from nymphs, and, even if their corresponding imagines should become known, the different stages could hardly be associated together with any degree of certainty. Moreover, the identification of these nymphs may not be even approximately correct. Of the remains of adult specimens, one only—the subject of the present paper—is known from the Eocene. Both *Anax metis*, Heer, from the Miocene of Radoboj, Croatia, and *Æschna separata*, Scudder, from the Miocene of Florissant, Colorado, have been referred by Needham to the Nearctic genus *Oplonæschna*. These two species, as well as *Lithæschna needhami*, Cockerell (Miocene of Florissant), differ from *Triæschna gossi* in respect that in them the vein Rs remains unbranched. As to *Lithæschna*, in 1913 Professor Cockerell considered that it "is perhaps too close to *Gomphæschna*" (Proc. U.S. Nat. Mus. xlv. p. 579, footnote). *Æschna polydore* and *Æ. tyche*, both described by Heer from the Miocene of Oeningen, Baden, were considered by Scudder "to belong pretty certainly to *Æschna* s. s." According to Heer's figures (Neue Denkschr. Schweiz. Ges. xi. t. iv. figs. 6, 7, 1850 [1849]), both these fossils are greatly lacking in venational detail, and their exact generic position must be regarded as doubtful. But, however this may be, they appear to differ from the Bournemouth fossil in several characters of importance. Thus, in the Oeningen insects the branches of the media are more distinctly separated from each other at their origin, the trig. suppl. is not developed, and Rs bifurcates more distally, as well as asymmetrically. In addition, the *Triæschna* wing is at least half as long again as the wings of Heer's species. *Æschna solida*, Scudder, Miocene of Florissant, has been declared by Needham to be "the only fossil *Æschna* that seems to fit that name in the modern sense of it" (Proc. U.S. Nat. Mus. xxvi. p. 761, 1903).

Since the appearance of Handlirsch's list, Cockerell has

published another species of *Oplonæschna* (*O. lapidaria*) from Florissant (Proc. U.S. Nat. Mus. xlv. p. 577, 1913).

The nearest relatives of *Triæschna* are to be found among the *Æschninae* of the present day, rather than among the Miocene species which we have just considered. In the linear arrangement of the subfamily proposed by Dr. E. M. Walker, it would seem to find its proper place as a member of the *Brachytron* group of genera, and of the *Brachytron* series in that group ('N. Amer. Dragonf. Genus *Æshna*,' p. 25, 1912). *Lithæschna*, also, alone of the Miocene forms, apparently belongs to the *Brachytron* group, although not to the same series. The phylogenetic tree on p. 24 of the work cited shows the great branch formed by this group as ending with three twigs, representing the closely-allied genera *Brachytron* (Europe and Asia Minor), *Epieschna* (North America), and *Æschnophlebia* (Japan). With these Holarctic genera *Triæschna* may be fittingly associated; but, even at the first glance, it is seen to differ from them by reason of the narrowness of the fore-wing. The antenodals, too, are far more numerous, *Triæschna* possessing 33 of those cross-veins, as compared with 13-15 in *Brachytron*, 21-23 in *Epieschna*, and 18-24 in *Æschnophlebia* (R. Martin, Coll. Selys, *Æsch.*, fasc. xix. pp. 86, 129, 139-140, 1909). Of greater significance still is the fact that in *Triæschna* there are as many as three rows of cells between the radial sector and the radial supplement, instead of two rows, as in *Æschnophlebia* and *Epieschna*, or one row only, as in *Brachytron*. In *Triæschna* the pterostigma is of moderate length, and is distinctly, if weakly, braced, whereas in *Brachytron* and *Æschnophlebia* it is very long and not braced at all. *Triæschna* may be further differentiated from *Æschnophlebia* by the subcosta not being prolonged beyond the nodus. In *Epieschna heros*, Fabr., it is evident that we have a very near relative of *Triæschna gossi*, and the resemblance between them is unmistakable, not only as regards general plan, but also in respect of such characters as the shape of the triangle, the presence of three rows of cells between M_4 and the median supplement, and the retracted position, reduced length, and undecided bracing of the pterostigma. Nevertheless, as we have seen, there are differences of importance, and the narrowness of the fork of the radial sector in *Triæschna* may be added to the other distinguishing characters to which attention has been directed.

In conclusion, it may be pointed out that the Bournemouth fossil indicates a dragonfly of great size, surpassing in alar expanse any species now occurring in the British Isles, as

well as all known Tertiary *Æschninæ*. With one exception, the length of wing is greater also than in any of the recent forms with which we have compared *Triæschna*. It is interesting to find that the exception in question is furnished by *Epieschna heros*, the largest representatives of which would about equal *Triæschna fossi* in spread of wing.

EXPLANATION OF PLATE XI.

Triæschna gossi, gen. et sp. n., $\times 1\frac{3}{4}$. Bartonian of Bournemouth.
Type, Brit. Mus. (Nat. Hist.).

XXIV.—*On Small Mammals obtained in Sankuru, South Congo, by Mr. H. Wilson.* By OLDFIELD THOMAS.

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THE British Museum has received from Mr. H. Wilson, of Inkongo, on the Sankuru River, Southern Belgian Congo, a small collection of mammals which are of sufficient interest to deserve a list of them being published. This region of the Congo has been little worked, and it is not surprising that several of the forms need description as new.

It is to be hoped that Mr. Wilson may be able to obtain a complete series of the local Mammalia, as all are certain to form valuable additions to the National Collection.

1. *Hemigalago demidoffi*, Fisch.

♂. 15, 27. Inkongo.

“‘Kashila.’ Common in woods.”—H. W.

2. *Eidolon helvum*, Kerr.

♂. 31; ♀. 32. Inkongo.

“Very common.”—H. W.

3. *Saccolaimus peli*, Temm.

♀. 33. Inkongo.

“Shot in evening hunting insects.”—H. W.

4. *Crocідura* sp.

♀. 2. Inkongo.

5. *Mungos ichneumon*, L.

♂. Inkongo.

6. *Anomalurus jacksoni perustus*, subsp. n.

♀. 35. R. Lubefu, 75 miles north of Lusambo. Alt. 500 m. 12th February, 1915. B.M. no. 16. 5. 15. 9.
Type.

"Native names 'Luchiyu' or 'Lukuyi' (Bakuba dialect). Well known to natives everywhere."—*H. W.*

Similar to true *jacksoni* in all essential characters, but the body-colour, instead of being clear grey, much more brownish olivaceous. Median area of face little lighter than rest of upper surface, while in *jacksoni* it is a whiter greyish.

Dimensions of type (as given by collector):—

Head and body 300 mm.; tail 250; hind foot 52; ear 33.

Skull: condylo-incisive length 53; zygomatic breadth 37; upper cheek-tooth series 12.

An imperfect skin of this animal from Batempas, Sankuru, was presented to the Museum by Mr. E. Torday in 1909, and a second, obtained further east at Baraka, on the west coast of Tanganyika, by Capt. Pauwels, was given by the Tervueren Museum in 1912. Now that this third specimen again shows the same more brownish-olivaceous colour as compared with the dozen examples we have of true *jacksoni* from Uganda and the Upper Welle, I think it advisable to give the more southern form a special subspecific name.

Further south still, in Katanga, occurs the quite distinct *A. neavei*, Dollm.

7. *Anomalurus beecrofti*, Fraser.

Immature ♀. 34. Tchimbangu, 60 miles west of Inkongo.

"This is the less-known of the two species of flying squirrel recognized by the natives."—*H. W.*

Like other immature specimens of *A. beecrofti*, this specimen is very greyish, with grey rump and parachute.

On laying out the specimens of *beecrofti*, however, I find that while all the specimens from the west of the Niger are more greyish, representing *laniger*, Temm., of Liberia and the Gold Coast, and *argenteus*, Schwann, of Southern Nigeria, those from S. Cameroons, Spanish Guinea, and Gaboon average much deeper in tone, and these have been taken for the typical *beecrofti*.

But the type of *beecrofti*, said to be from Fernando Po, and other specimens closely agreeing with it, from about 7000–8000' on the Cameroon mountains, together represent yet another race, characterized by its much longer fur and deeper greenish coloration. I therefore propose to describe the more southern form as follows:—

Anomalurus beecrofti citrinus, subsp. n.

Fur, as in the other lowland forms, comparatively short, about 16 mm. in length on the back, that of the type and other highland specimens being nearly 30 mm. long. General colour strong yellowish or ochraceous olive, citrine or citrine drab, varying very much in tone, but averaging very much stronger and darker than in the Gold Coast and Nigerian forms; the parachute in adult specimens practically of the same colour as the back, not distinctly greyer. Under surface washed with deep reddish ochraceous, also rather variable in tone.

Dimensions of the type:—

Head and body 357 mm.; tail 225; hind foot 60; ear 28.

Skull: greatest length 58·5; condylo-incisive length 53; zygomatic breadth 38; upper tooth-series 12·8.

Hab. Lowlands from South Cameroons southwards to the Gaboon. Type from the Benito River, Spanish Guinea.

Type. Adult female. B.M. no. O. 2. 5. 15. Original number 426. Collected by Mr. G. L. Bates. About a dozen specimens examined.

8. *Helosciurus rufobrachiatus*, Waterh.

♂. 28. Inkongo.

“Native name ‘Munkeyemi.’ Common in the big forests near the river. More local than the Nkôca.”—*H. W.*

9. *Funisciurus congicus interior*, subsp. n.

♂. 21; ♀. 30. Inkongo.

A strongly coloured race; the light lines yellowish instead of white.

Most nearly allied to true *F. c. congicus*. General colour of body more suffused with yellow than in that form, the shoulders, back, and flanks strongly washed with rich yellowish (near “sulphine-yellow”). Head, however, more brownish grey, the crown quite brown; postauricular patches dull whitish. Light lateral stripes yellowish, markedly different from those of the other races. Dark bands external to the light ones well-marked, strongly defined. Rump and sides of hips with a slight brownish rufous tinge. Throat and inner side of fore limbs, inguinal region, and inner side of hind limbs greyish white with a slight bluish tinge, not yellowish as in *congicus*; belly brownish white. Hands and feet grey, not yellowish as in other forms. Tail dark, the hairs with broad black subterminal band and yellowish-white tip.

Dimensions of the type (measured in flesh):—

Head and body 154 mm.; tail 151; hind foot 41; ear 16.

Skull: condylo-incisive length 35.3; zygomatic breadth 22; upper tooth-row 6.9.

Hab. (as above).

Type the female (barely adult). B.M. no. 16. 5. 15. 12. Killed 3rd November, 1915.

This subspecies is readily distinguishable from the other three, which were characterized in 1904*, by its yellower body-colour, yellowish light dorsal stripes, grey hands and feet, the rufous-brown tinge of the rump and hips, and the greyish-white colour of the throat and inguinal regions. Thanks to the work of the late Dr. W. J. Ansorge, the Museum contains good series of the Western Angolan races of *congius* (Kuhl's type agreeing absolutely with that of N. Angola), and now the present examples from the Sankuru add considerably to the known range of the species, and form the first specimens we have had coming unquestionably from the area of the Congo.

10. *Dendromus peci'ei*, M.-Edw.

♂. 8, 26; ♀. 7, 9. Inkongo.

(7) Common on grass-land. (26) Trapped in clearing of bush.

Determination provisional. The condition of the specimens renders it difficult to be certain if 26 is of the same species or even of the same group of the genus as 7; 8 and 9 are the young of the latter.

In trying to determine these specimens, I have come to the conclusion that it would be a convenience if the forms with a nail on the fifth hind toe were separated subgenerically from those with a claw. The remarkable *D. lovati*, de Wint., of Abyssinia, might also form a special subgenus.

The following arrangement is suggested:—

A single dark line down back, or none.

Fifth hind toe with a claw Subgenus *Dendromys*, s. s.

Genotype *D. mesomelas*, Brants. Other species: *D. insignis*, Thos., *acraeus*, Wr., *pumilio*, Wagn., *messorius*, Thos., *ruddi*, Wr., *ansorgei*, Thos. & Wr., *jamesoni*, Wr.

* Ann. & Mag. Nat. Hist. (7) xiii. p. 411 (1904). Now, however, that I have seen to what extent bands and streaks may be altered seasonally by squirrels, I am inclined to think it possible that *F. congius congius* and *F. c. olivellus* represent seasonal pelages of the same race. But further dated specimens will be needed before this can be definitely proved.

Fifth hind toe with a nail Subgenus *Poemys*, nov.

Genotype *D. melanotis*, A. Sm. Other species: *D. nigri-*
frons, True., *nyikæ**, Wr.

Three dark stripes down back, the middle one lightened along centre.

Fifth hind toe with a small claw hidden

by hair..... Subgenus *Chortomys*, nov.

Genotype *D. lovati*, de Wint.

I can find no constant cranial distinction between *Dendromus* and *Poemys*, but the skull of *Chortomys* has a certain general resemblance in shape to that of *Malacothrix*.

The difference in these animals between a "claw" and a "nail" is not very great, as the claws are small—far smaller than those of the median digits—and their points only slightly surpass the ends of the pads below them. That the subgenera *Dendromus* and *Poemys* are distinct groups, however, is indicated by the fact that in nearly every part of Africa one species of each of them is found, living side by side, and thus showing that there is a real distinction between them.

11. *Rattus rattus*, L.

♂. 18. Inkongo.

12. *Rattus (Æthomys) longicaudatus*, Tullb.

♂. 10, 20, 24. Inkongo.

13. *Rattus (Praomys) tullbergi*, Thos.

♀. 25. Inkongo.

14. *Malacomys wilsoni*, sp. n.

♂. 17. Inkongo. B.M. no. 16. 5. 15. 32. *Type*.

"Trapped on creepers overhanging stream."—H. W.

General characters as in *M. longipes*, but a greyish-white frontal patch present and skull different in details.

Size rather less than in *M. longipes*, but in this genus there is always considerable variation in this respect. General colour of type, in bleached pelage, rather paler than the palest of the series of other *Malacomys*, back approaching Ridgway's "wood-brown." Head mouse-grey, but the top of muzzle, area round eyes, and top of crown blackish, surrounding a conspicuous greyish-white frontal patch, the frontal being much lighter and the surrounding areas darker than in the other species. Colour elsewhere as usual. Tail bicolor, dark above and whitish below, but this varies in *M. longipes*.

* The typical skin and two others. The specimens mentioned as with grey-based belly-hairs belong to a different species, a member of *Dendromus*, s. s., and therefore with a claw on the fifth digit.

Skull.—Nasals comparatively short and broad, less narrowing backwards than usual. Anteorbital plate short, little projected forwards. Interorbital region not so elongate and parallel-sided as in *M. longipes*, its edges sharply squared and forming ridges evenly divergent backwards. In *M. longipes* the greater part of the supraorbital margin is smoothly rounded, the inconspicuous ridges only commencing posterior to the olfactory-cerebral constriction.

Dimensions of the type (measured in flesh):—

Head and body 151 mm.; tail 180; hind foot 38; ear 27.

Skull: back of parietals to tip of nasals 35·3; zygomatic breadth 17; nasals 16·2 × 4·8; interorbital breadth 6·8; palatilar length 18·2; palatal foramina 6; upper molar series 5·7.

This new species of the interesting genus *Malacomys* is distinguished by its contrasted grey and blackish face-markings and the structure of the interorbital region of its skull. I have much pleasure in naming it after Mr. Wilson, to whom we are indebted for the collection of which it forms a part.

Now that I have seen how much the skulls of *Malacomys* may differ in size in the same locality, I have considerable doubt as to the specific validity of *M. centralis*, de Wint., which was distinguished mainly on size. The skull used as representative of *M. longipes* by Mr. de Winton was unusually small, and has since been supplemented by others from the same region quite as large as average *M. centralis*.

15. *Ænomys hypoxanthus*, Puch.

♂. 19. Inkongo.

16. *Lemniscomys striatus*, L.

♂. 1, 5, 6, 14, 22; ♀. 3, 4, 12. Inkongo.

“‘Lubasha.’ Common on open grass-land.”—H. W.

17. *Hybomys univittatus*, Pet.

♂. 23. Inkongo.

“‘Trapped in wood.’”—H. W.

18. *Thamnomys rutilans*, Pet.

♀. 16. Inkongo.

“‘Killed in clearing at edge of forest.’”—H. W.

19. *Grammomys surdaster*, Thos. & Wr.

♂ (young). 13; ♀. 29. Inkongo.

“‘Trapped on site of old clearing.’”—H. W.

XXV.—*On the Generic Names Rattus and Phyllomys.*
By OLDFIELD THOMAS.

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SINCE my paper on *Rattus* as a generic name appeared in the last number of the 'Annals,' two papers, by Messrs. Hollister and Goldman, affecting the questions there dealt with have arrived from America.

I ventured to hope that no earlier use of *Rattus* than Fischer's in 1814 would be found, as that would probably upset *Epimys* for the genus containing the common rats. This hope has been disappointed, for Mr. Hollister* has found a use by the same author in 1803† of *Rattus* for the ordinary rats, with type *Mus rattus*‡; and there being no way in which we can escape admitting its validity, we must discard *Epimys* and accept *Rattus* as the generic name for the large genus of true rats.

As a consequence, my attempted use of *Rattus* for Azara's Spiny-rat fails, and this animal will have to bear the burden of *Euryzygomatomys* as its generic name.

From the species which have commonly been placed in "*Loncheres*," but which, as already shown, must bear the name *Echimys*, Mr. Goldman§ has taken out a certain number with simple laminated molars, and for these he proposes to use the name *Phyllomys*, Lund.

But, in the first place, *Phyllomys* is antedated by *Nelomys*, Jourdan, whose type is *N. blainvillei*, which has obviously the same laminated upper molars, and, in the second, the north-western species *caniceps*, with, presumably, *labilis* and *darlingi*, differs from it by having the lower molars also simply laminated, which is not the case in *Nelomys*. I would, therefore, propose to make a new genus, *Diplomys*, for these species, with *Loncheres caniceps*, Günth., as genotype. Other species of true *Nelomys* are *brasiliensis*||, *thomasi*, *medius*, and *dasythrix*.

* P. Biol. Soc. Wash. xxix. p. 126 (1916).

† National Mus. Naturg. Paris, ii. p. 128 (1803).

‡ Mr. Hollister mentions "*M. decumanus*" as the type; but the genus is distinctly made for the "Ratte," French "Rat," = *Mus rattus*, the mention of *M. decumanus* being merely as "the most remarkable of the other species."

§ P. Biol. Soc. Wash. xxix. p. 125 (1916).

|| Mr. Goldman unites *brasiliensis* with *armatus*, Geoff.; but the latter is the Guiana red-cheeked species, a true *Echimys*, and my *Loncheres guianæ* is no doubt synonymous with it.

XXVI.—*Three new African Mice of the Genus Dendromus.*
By OLDFIELD THOMAS.

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Dendromus nyasæ, sp. n.

Near *D. mesomelas*, but tail shorter.

General characters, including the presence of a claw on the fifth hind toe, as in *D. mesomelas*. Colour above about as in that species, though rather darker, this difference being more marked on the flanks, which are less fulvous and more tawny. Under surface more heavily mixed with slaty, the white ends to the hairs shorter, and only those on the chin white to the roots. A well-marked black dorsal stripe present. Tail decidedly shorter than in *mesomelas*, dark brown above, a little lighter below.

Skull about as in *mesomelas*.

-Dimensions of the type (taken on skin):—

Head and body 80 mm.; tail (vertebræ *in situ*) 85; hind foot (wet) 20·5.

Skull: greatest length 22·5; condylo-incisive length 20·2; zygomatic breadth 11·6; nasals 8·3; breadth of brain-case 10; palatilar length 9·3; palatal foramina 4·9; upper molar series 3·5; length of m^1 2·1.

Hab. Nyika Plateau, N. Nyasa. Alt. 6500'.

Type. Adult female. B.M. no. 97.10.1.121. Original number 119. Collected June 1896 by Mr. A. Whyte, and presented by Sir H. H. Johnston.

This species is based on the two specimens of true *Dendromys* with greyish bellies which, as indicated in a previous paper, were mixed up in Mr. Wroughton's account of his *D. nyikæ*. That species, as identified by the type skin, is a *Poemys*, with a nail on the hind toe, although, misled by these specimens, Mr. Wroughton stated that it had a claw.

D. nyasæ differs from its nearest ally, *D. mesomelas*, by its markedly shorter tail and darker-coloured flanks and under surface. There does not seem to be any sufficient reason for distinguishing *D. ayresi*, Roberts, from *D. mesomelas*, any more than the same author's *D. longicaudatus* from *D. melanotis*, but neither reasons for distinction nor general characters are, in any of this author's descriptions, sufficiently clearly stated to make certainty possible. Topotypical specimens give, therefore, the only means of elucidating his names, and in the present instance the Museum contains examples supporting the identifications I now make.

Dendromus insignis kivu, subsp. n.

Like true *insignis*, but averaging smaller, and with rather shorter fur. Colour quite similar, though the dorsal line is not quite so heavy; under surface washed with buffy.

Skull ranging from 22.5 to 24 mm. in total length, that of true *insignis* always about 25 mm. Supraorbital edge more sharply squared and with a greater tendency to the formation of supraorbital ridges, which run forward to the level of the hinder end of the nasals. Molars rather variable in size, m^1 in the type only 2.0 mm. in length, but in other specimens it may be 2.2 or 2.3 mm., as is usual in *insignis*.

Dimensions of type (measured in flesh):—

Head and body 75 mm.; tail 88; hind foot 18.5; ear 14.

Skull: greatest length 22.5; condylo-incisive length 19.6; zygomatic breadth 11; nasals 9; interorbital breadth 3.1; breadth of brain-case 10.3; palatilar length 9.2; palatal foramina 4.9; upper molar series 3.2; length of m^1 2.0.

Type. Adult male. B.M. no. 11.12.3.117. Original number 2170. Collected 31st May, 1911, by Robin Kemp; presented by Oldfield Thomas.

Hab. Kivu Region. Type from Buhamba, alt. 2000 m.; other specimens from Mukanda and Burunga.

While true *insignis* is very constant in size of skull, this form, from further south near Lake Kivu, is curiously variable; but all the six specimens available are distinguishable by the characters above detailed.

I confess I fail to see sufficient reason for the distinction from *D. insignis* of the Mt. Gargues "*Dendromus mesomelas percivali*," Heller, our series from the Aberdares containing specimens agreeing both in colour and skull with the type of *insignis*, and others with the topotypes of *percivali* given us by Mr. Percival. The lumping of *insignis* with the southern *D. mesomelas* appears equally unfounded.

Dendromus (Poemys) nigrifrons vulturinus, subsp. n.

Similar in all essential respects to true *D. nigrifrons*, but the hairs of the whole underside broadly washed with buffy above their slaty bases. Frontal and dorsal markings well-defined. General colour of back as in *nigrifrons* or slightly more buffy.

Dimensions of the type:—

Head and body 70 mm.; tail 75; hind foot 17.

Skull: tip of nasals to back of interparietal 20; palatilar

length 8·6; palatal foramina 4·5; upper molar series 3·1; length of m^1 1·7.

Hab. (of type). Chirinda Forest, Melsetter, Rhodesia. Other specimens from Mazoe, Mashonaland (*J. ff. Darling*), and Legogot, Barberton, Transvaal (*Rudd Exploration*).

Type. Adult male. B.M. no. 8. 7. 19. 39. Collected and presented by C. F. M. Swynnerton, -Esq.

Four specimens of *D. nigrifrons* from S.E. Africa agree in their strongly buffy undersides in contrast with the greyish or only faintly buffy colour found in East-African and Nigerian specimens of *D. nigrifrons*. Heller has distinguished a *D. spectabilis* (locality Lado) from the Kilima-njaro *D. nigrifrons*, because of its "pearl-grey" and not buffy underparts. But all our East-African specimens are more or less greyish below, and the type was said to have the "underparts white, tinged with yellowish brown." No white of any shade occurs on the Rhodesian form.

XXVII.—On the Occurrence of the Tropical Fowl Mite (*Liponyssus bursa*, *Berlese*) in Australia, and a new Instance of its attacking Man. By STANLEY HIRST.

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IN a little paper entitled "On a widely distributed Gamasid Mite (*Leiognathus morsitans*, sp. n.), parasitic on the Domestic Fowl"*, I described a blood-sucking mite found on the fowl in several parts of Africa, the Comoro Islands, Mauritius, China, India, the Bahamas, and Columbia. Two instances of this mite attacking Man are given in the paper just mentioned.

Judging from its distribution, I have come to the conclusion that this species is the same as that described by Prof. Antonio Berlese under the name *Leiognathus bursa* from specimens collected at Buenos Aires. Mr. F. W. Urich, Government Entomologist at Trinidad, has recently sent specimens of this mite found on the domestic fowl in that island to the Imperial Bureau of Entomology. The British Museum has just received specimens from Dr. J. Burton Cleland found swarming on a sitting-hen at Sydney, Australia (ii. 1916).

* Bull. Ent. Res. vi. pp. 55-58, 3 text-figs. (1915).

In the same consignment of parasitic Acari, he also sent examples of *L. bursa* found biting human beings at Cremorne, Sydney (10. xii. 1915). Dr. Cleland suggests the possibility of their having come from English starlings building in the house. In his important paper on "Injuries and Diseases of Man in Australia attributable to Animals (except Insects)"*, Dr. Cleland says:—

"*Gamasids from Fowls*.—Gamasids, probably *Dermanyssus avium*, sometimes pass from fowls and chickens to persons handling them, when the irritation they cause produces a rash. An instance of this at Port Pirie, in South Australia, has been mentioned to me, and doubtless many others have occurred."

"*Gamasids from Starlings*.—In Sydney, it has been reported that in some cases, where English starlings have built in the roof, the dwellers in the house have suffered much irritation from mites introduced by the birds. In one case, in a church, it is said that the roof had to be renovated on account of the annoyance caused to the congregation by these creatures. The mites, Dr. T. Harvey Johnston tells me, may prove the same as the one on fowls."

It is probable that both the Gamasids from fowls and starlings mentioned in the above extracts are referable to *L. bursa*, as were those from the same hosts forwarded to me for examination. It is a remarkable fact that the European fowl-mite (*Dermanyssus gallinæ*, Redi) apparently does not thrive in tropical and subtropical countries. I have examined numerous batches of Gamasid fowl-mites from different parts of the tropics, and there has never been a single specimen of *Dermanyssus gallinæ* amongst them. The species sent was always *L. bursa* (*L. morsitans*, mihi). *Liponyssus bursa* can easily be distinguished from *D. gallinæ* by the structure of its chelicerae (mandibles), which are in the form of pincers, instead of each of them being a long fine style; the shape of the dorsal scutum is also very different, &c. The wide distribution of *L. bursa* is possibly due to this mite being carried about by the common sparrow. It is practically certain that when the name *Dermanyssus gallinæ* is met with in reports by entomologists on the parasites of the fowl in tropical countries, *Liponyssus bursa* is the species really concerned.

* J. Trop. Med. xvi. pp. 43-47 (1913); reprinted from Austr. Med. Gaz. (1912).

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XXVIII.—*New and little-known Tipulidæ, chiefly from Formosa.* By F. W. EDWARDS, B.A., F.E.S.

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[Plate XII.]

I RECENTLY received for examination from Dr. T. Shiraki, Chief Entomologist at the Agricultural Experiment Station in Formosa, a collection of Tipulidæ from that island. So far as I am aware, only seven species of crane-flies have hitherto been recorded from Formosa, and it is therefore not surprising that this collection, the results of the study of which are set forth below, contained a large proportion of new and interesting forms. The types of all the new Formosan species described here, with the exception of that of *Tipula shirakii*, have been generously presented to the British Museum collection by Dr. Shiraki. Descriptions of a few other related forms already in the Museum's possession have been included. Most of the new species from Formosa were collected at Arisan, a mountain locality 8000 feet above sea-level.

LIMNOBIINÆ.

LIMNOBIINI.

Dicranomyia fullowayi, Alex.

2 ♀, Arisan, 10. x. 1912 (*I. Nitobe*).

These specimens agree sufficiently well with Alexander's
Ann. & Mag. N. Hist. Ser. 8. Vol. xviii. 17 /

description (Can. Ent. 1915, p. 79). This and *D. punctulata*, Meij., are evidently closely allied, the latter differing chiefly in its thoracic markings.

Dicranomyia alticola, sp. n. (Pl. XII. fig. 1.)

Head blackish, rather shining, rostrum and palpi black, antennæ dark brown. Two or three basal joints of the flagellum nearly spherical, remainder gradually becoming more elongate, each bearing two or three hairs near the base which are not much longer than the joints. *Thorax* shining ochreous; pronotum and central area of front half of præscutum brownish; pleuræ lighter ochreous, unmarked. *Abdomen* (see fig. 1) uniformly dark brown above; uniformly ochreous below, except that the swollen bases of the valves of the ovipositor (*gs*) are shining black. The anal cerci (*i. e.*, the dorsal valves of the ovipositor) are very short, being very little longer than the tenth tergite; the ninth tergite is nearly three times as long as the tenth and considerably longer than the eighth. *Legs* brownish, tips of femora darker; claws each with a single tooth. *Wings* hyaline, iridescent; stigma light brown, but distinct; no other markings. Sc_1 ends in costa at about two-fifths of the distance from the base to the apex of R_s ; Sc_2 more than twice its own length distant from the tip of Sc_1 . R_s arising well beyond the middle of the wing, gently curved at its base, not much more than half as long as R_{2+3} . R_1 turned sharply up to the costa at the marginal cross-vein. $R-M$ cross-vein present. Cu_1 meeting M either just before, at, or just after the fork; cell 1st M_2 twice as long as its average breadth, not quite as long as cell M_1 or 2nd M_2 . *Halteres* with light stem and blackish knob.

Length of body 7.5 mm.; wing 8 mm.

1 ♀, Arisan, 10. x. 1912 (*I. Nitobe*); 1 ♀, Horisha, v. 1913 (*M. Maki*).

Perhaps most nearly allied to *D. alta*, Meij., but certainly distinct. The species of this group, which seems to be numerously represented in the Oriental Region, approach *Limnobia* in the lengthened Sc_1 and make the distinction between the two genera rather uncertain.

Geranomyia septemnotata, sp. n.

Head blackish grey; eyes nearly contiguous above and absolutely so below. Proboscis black, a little longer than the head and thorax together. Antennæ missing. *Thorax* reddish brown above; three rather narrow dark brown stripes

on the præscutum, the lateral pair commencing at the pseudosuture and extending also over the scutum. Scutellum with an indistinct darker central line. Pleuræ ochreous. Prothorax dark brownish. *Abdomen* dark brown above, venter and ovipositor ochreous. Tenth tergite longer than the eighth and ninth together, but shorter than the anal valves, which project slightly beyond the tip of the ventral (ninth sternal) valves of the ovipositor. *Legs* uniformly light brownish. *Wings* with a slight brownish tinge; the seven dark costal spots, also the other markings and the venation, as in *G. avocetta*, Alex. *Halteres* blackish, stem lighter.

Length of body (without proboscis) 5.5 mm.; wing 6 mm.

1 ♀, Arisan, 10. x. 1912 (*I. Nitobe*).

This insect, though very close to *G. avocetta*, Alex., *G. semifasciata*, Brun., and *G. semistriata*, Brun., seems to be distinct from any of them.

Limnobia nitobei, sp. n. (Pl. XII. fig. 2.)

Head blackish, grey-dusted; rostrum, palpi, and antennæ black, the second antennal joint partly ochreous; flagellar joints oval, hairs as long as the joints. *Thorax*: neck and prothorax yellowish. Præscutum ochreous, somewhat shining; a broad blackish stripe along each side-margin, nearly interrupted at the pseudosuture, but not reaching the front; two lines of black hairs. Scutum occupied almost entirely by two blackish spots. Scutellum shining blackish, yellowish in the middle towards the base. Postnotum dark brownish, pleuræ mainly so. *Abdomen* ochreous, the segments with dark brown basal bands, ill-defined but broad. *Genitalia* (fig. 2). *Legs*: coxæ ochreous. Femora ochreous; tips black; another rather narrower black ring at the base of the apical third. Tibiæ ochreous, with black tips. Tarsi black, base of first joint ochreous. Claws with one distinct tooth near and some bristles at the base. *Wings* with a slight yellowish tinge and rather numerous brown clouds, which occur over the tips of most of the veins, also over the base of Rs, over the cross-veins, and in the basal and inner marginal cells. Sc₂ at tip of Sc₁. R₁ ending in the costa some distance beyond the marginal cross-vein. Rs arising just beyond the middle of the wing, rather strongly arched. Base of cell M₁ nearer wing-base than that of cell 2nd M₂. Cu₁ joining M before the fork. *Halteres* ochreous.

Length of body 7 mm.; wing 7.5 mm.

1 ♂, Arisan, 10. x. 1912 (*I. Nitobe*).

A small species somewhat resembling the European *L. flavipes*, F. It seems to have no near relative amongst the described Oriental species.

Libnotes regalis, sp. n.

Head missing. *Thorax* (damaged) ochreous, dusted over with yellowish grey; præscutum with four rather ill-defined blackish-brown yellowish-grey dusted stripes on the posterior half, and with a dark mark at the side towards the front; scutum with a pair of somewhat triangular dark spots; scutellum dark at each side. *Pleuræ* mainly dark, an ochreous spot on the upper half of the sternopleura. *Abdomen* missing. *Legs* ochreous; tarsi more brownish; a narrow and rather indistinct dark ring near the tips of the femora. Claws with three or four distinct teeth, the largest nearest the apex. *Wings* remarkable for having two adventitious cross-veins, placed in the cells R_{2+3} and R_{4+5} (submarginal and first posterior), the venation otherwise resembling that of the *L. pæciloptera* group: R_1 ends in the costa a short distance beyond the marginal cross-vein; M_{1+2} forks beyond the middle of cell 1st M_2 , which is nearly four times as long as its greatest breadth. Cu_1 meets M_3 halfway between the base of cell 1st M_2 and the fork of M_{1+2} . *Ax* is strongly curved downwards at its tip. Ground-colour of wings yellow. A deeper yellow spot over the base of Rs , surrounded with a black border, from the lower edge of which a streak is emitted towards the base of the wing. Black streaks over many of the veins; a blackish spot on the wing-margin in the cell *An* and another at the anal angle. The cord and all the cross-veins, also the base of M_2 , are broadly margined with black, though these veins themselves remain of the yellow ground-colour. *Halteres* with yellow stem and black knob.

Size of wing 25×6 mm.; length of front leg 43 mm.; middle leg 40 mm.; hind leg 42 mm.

This is quite the most remarkable species yet described in this genus. It is unfortunate that the specimen, like some others in the collection, had been damaged by ants.

Taihoku (*T. Shiraki*). One specimen.

ANTOCHINI.

Teucholabis nigerrima, sp. n.

Head, thorax, abdomen, and legs entirely shining black, black-haired. Wings blackish, a pale streak in cell *Ax*.

Halteres black. Venation as in *T. fenestrata*, O.-S. Antennæ scarcely as long as the thorax, most of the flagellar joints globular, gradually decreasing in size towards the apex of the antennæ, last three or four joints more elongate.

Length of body 10 mm.; wing 9 mm.

Horisha, 10. v. 1913 (*M. Maki*), 1 ♂; Taihoku (*T. Shiraki*), 1 ♂.

Gymnastes ornatipennis (de Meij.).

Arisan, 10. x. 1912 (*I. Nitobe*), 2 ♀.

I have recently (*Ann. & Mag. Nat. Hist.*, May 1916, p. 359) suggested that this species be transferred from *Gnophomyia* to *Gymnastes*. In the paper referred to I mentioned a specimen from Japan which is in the British Museum collection. This specimen was taken at Idzu, vi. 1910 (*S. Akiyama*); it differs from typical *ornatipennis* in having the basal wing-fascia broader and extending from the costa to the hind margin; the first mid-tarsal joint is yellowish with a black tip, instead of all black, and the basal two-thirds (not half only) of the first hind tarsal joint is yellow.

Dasymallomyia signata, Brun.

Horisha, 10. v. 1913 (*M. Maki*), 1 ♀.

I am not convinced that Alexander is justified in sinking this genus under *Gnophomyia*; it seems to me it might with almost equal reason be included in *Teucholabis*. The name had, therefore, better be allowed to stand at least until the Oriental species are better known. Brunetti did not describe the antennæ. In this specimen the flagellar joints are rather shortly oval, two or three at the base round; they are provided with a verticil of long hairs, nearly three times as long as the joint, just before the middle; the base is yellowish, the remainder dark.

Antocha sp.

Horisha, 10. v. 1913 (*M. Maki*), 1 ♀.

Very much like the European species, and may, perhaps, be the same, but the thorax is without any trace of darker stripes, and the scutellum is grey instead of ochreous. Since it is still uncertain whether the European species is or is not the same as the North-American *A. opalizans*, I refrain from naming this specimen.

Atarba pallidicornis, sp. n.

Head dull, pale yellow. Antennæ wholly pale yellow;

first scapal joint not longer than the second; flagellar joints rather elongate-oval, all about equal in length, with scattered light brownish hairs; whole antenna about as long as the head and thorax together. *Thorax* moderately shining. Prothorax pale yellow. Præscutum rather dark brown, with a broad pale yellow median stripe from the front margin almost to the suture; the dark colour at the sides does not quite reach the front. Scutum, scutellum, and postnotum almost wholly brown, the first-named with a small yellowish spot just behind the suture. Pleuræ wholly pale yellow. *Abdomen* pale yellowish, hind margins of tergites 1-5 brown. *Legs* yellowish, femora and tibiæ narrowly black at the tips; tibiæ without any trace of spurs*. *Wings* with both membrane and veins pale yellowish. Venation much as in *A. flava*, Brun., but Sc_1 a little longer and cells M_1 and 2nd M_2 rather shorter; M_2 and M_3 rather more divergent. *Halteres* pale yellowish.

Length of body or wing 6 mm.

Arisan, 10. x. 1912 (*I. Nitobe*), 1 ♀.

Atarba fuscicornis, sp. n.

Head shining ochreous. Antennæ wholly blackish, a little shorter than in *A. pallidicornis*, last few flagellar joints distinctly shorter than those at the base. Labella yellowish, palpi black. *Thorax* shining. Præscutum and scutum ochreous in the middle, blackish brown at the sides up to the front margin. Scutellum ochreous. Postnotum brownish. Pleuræ ochreous. *Abdomen* dark brownish above, ovipositor and venter ochreous. *Legs* uniformly yellowish, tibiæ without spurs. *Wings* almost hyaline, veins yellowish; venation as in *A. flava*, Brun., except that R_s is more arched at the base. *Halteres* ochreous.

Length of body 5.5 mm.; wing 6 mm.

Arisan, 10. x. 1912 (*I. Nitobe*), 1 ♀.

ERIOPTERINI.

Gnophomyia orientalis, de Meij.

Arisan, 10. x. 1912 (*I. Nitobe*), 1 ♀.

This species, which I think must be correctly named, agrees with *G. nigrescens*, Edw., in coloration and venation,

* An African species recently described by Riedel as *Leiponeura jeanneli* (represented in the British Museum) has small but distinct tibial spurs.

but differs in the shorter ovipositor, the rather more conspicuous hairs on the veins, and the finer microscopic hairs on the surface of the wings.

Gnophomyia similis, sp. n. (Pl. XII. fig. 3.)

Differs from *G. orientalis* as follows:—Ovipositor much longer and straighter, the anal valves more than twice as long as the ninth and tenth tergites together; Cu_1 meeting M well beyond the middle of cell 1st M_2 ; microscopic hairs on the wing-surface finer, scarcely visible as dark dots under a magnification of 80.

Length of body 6 mm.; wing 6.3 mm.; ovipositor 1 mm. Arisan, 10. x. 1912 (*I. Nitobe*), 1 ♀.

Molophilus costalis, sp. n.

Head yellow; proboscis and palpi black; antennæ with the first four or five joints yellow, remainder brownish; flagellar joints oval, with long hairs near the base and shorter ones near the apex. *Thorax* dull light reddish ochreous above, margins of mesonotum yellow; pleuræ ochreous brown, rather shining. *Abdomen* rather light brownish ochreous; lateral line and seventh tergite somewhat darker; ovipositor bright ochreous. *Legs* ochreous; tarsi and tips of tibiæ blackish brown. *Wings* greyish, whitish at the base; costa and wing-tip with yellow hair; hair on remaining veins and fringe dark grey. Bases of cells R_2 and M_3 at practically the same level. *Halteres* yellow.

Length of body or wing 4 mm.

Arisan, 10. x. 1912 (*I. Nitobe*), 3 ♀.

Erioptera (Erioptera) insignis, sp. n.

Head blackish, with a whitish-grey border to the eyes. Proboscis pale, palpi and antennæ dark brown. Antennæ about as long as the thorax; basal flagellar joints oval, last few elongate. In the male the flagellar joints bear very long hairs on the upper side, shorter ones below; in the female the hairs are much shorter. *Thorax* rather dark reddish brown, without distinct markings; pleuræ with a bluish-grey sheen, especially when looked at obliquely from above. *Abdomen* dark brown above, genitalia and venter ochreous. The male hypopygium rather closely resembles that figured by de Meijere for *E. notata*. *Legs* ochreous brown; femora with a rather indistinct dark brown ring just before the tip. *Wings* with a slight greyish tinge; the cord and Cu_1 rather

indistinctly dark-bordered. Base of cell R_2 markedly nearer the wing-base than that of cell M_3 ; $Cu_1 + M_3$ nearly twice as long as R_{2+3} . *Halteres* with pure white stem and dark brown knob.

Length of body or wing 4.5–5 mm.

Arisan, 10. x. 1912 (*I. Nitobe*), 1 ♂, 1 ♀; also 1 ♂ in British Museum from Tokyo, Japan (*C. H. B. Wood*).

This species differs slightly from *E. notata*, de Meij., and *E. javanensis*, de Meij., in venation; it resembles the latter in coloration, but the tips of the femora and tibiæ are not white.

Erioptera (Erioptera) alboguttata, sp. n.
(Pl. XII. fig. 4.)

Head yellow; proboscis, palpi, and antennæ black. Antennæ not much longer than the head, flagellum very slender, with rather short hairs. *Thorax*: pronotum yellowish. Mesonotum ochreous brown, rather darker on the margins. Pleuræ light ochreous, with an ill-defined dark brown longitudinal stripe in the middle, ground-colour rather darker below this stripe. *Abdomen* dark brown, genitalia (fig. 4) orange. *Legs* entirely yellow (front legs and hind tibiæ and tarsi missing). *Wings* brown, costa yellowish. A white spot over the base of R_s ; a white band over the cord; a large white spot on the costa just beyond this; five or six smaller white spots on the margin round the apical part of the wing, and another white spot over the apical half of cell, 1st M_2 , and the bases of cells M_1 and 2nd M_2 . $Cu_1 + M_3$ nearly three times as long as R_{2+3} . Cell 1st M_2 open on one wing, closed on the other. Cu_1a slightly recurrent (*i. e.*, inwardly oblique), joining M_3 a little beyond the fork.

Length of body 3 mm.; wing 3.5 mm.

Arisan, 10. x. 1912 (*I. Nitobe*), 1 ♂.

This is a most interesting species, since its venation would place it, according to Osten-Sacken's table, in the subgenus *Erioptera*; whereas in its spotted wings and recurrent Cu_1a it is clearly related to *Mesocyphona*. The discovery of this species adds support to Alexander's view that *Mesocyphona* should not be regarded as more than a subgenus of *Erioptera*. Williston's *E. annulipes* from St. Vincent is another species of this group.

Gonomyia (Lipophleps) nebulosa (de Meij.).

· Arisan, 10. x. 1912 (*I. Nitobe*), 2 ♀.

An immature male taken at the same time and place may also belong here.

Conosia irrorata, Wied.

Kotosho Island, 5. vii. 1912 (*T. Shiraki*), 1 ♀.

LIMNOPHILINI.

Ephelia fascipennis, Brun.

Arisan, 10. x. 1912 (*I. Nitobe*), 1 ♀.

The specimen corresponds fairly well with Brunetti's description and figure, but the minute dots on the wing are more numerous, and the dorsum of the thorax is grey with sharply defined spots and streaks.

ANISOMERINI.

Eriocera (Physecrania) unicolor, de Meij.

Horisha, 1000 ft. (*M. Maki*), 1 ♂.

Agrees very well with de Meijere's description, which was based on a specimen from Simalur, N.W. of Sumatra.

Eriocera (Androelosma) verticale, Wied.

Taihoku (*T. Shiraki*), 1 ♀.

Eriocera (Eriocera) sauteriana, End.

Kotosho Island, 20. vii. 1912 (*T. Shiraki*), 1 ♂; Arisan, 10. x. 1912 (*I. Nitobe*), 1 ♀.

The male is much smaller and more slender than the female.

Eriocera (Eriocera) rubriceps, sp. n.

Head dull red, proboscis and palpi black; antennæ dark brown except for the reddish first joint. Front moderately swollen, a small pit at the top of the swelling. First antennal joint stout, less than twice as long as broad, second globular, third half as long again as the fourth, cylindrical. *Thorax*: præscutum and scutum velvet-black, the former with four inconspicuous leaden-coloured but slightly reddish-tinged stripes. Scutellum, postnotum, and pleuræ entirely dull reddish brown. *Abdomen*: first tergite reddish orange with a black hind border; second to fifth orange with black hind borders; sixth and seventh velvet-black; eighth (mainly hidden) and ninth dull orange; valves of ovipositor shining brownish; venter chiefly orange, except on the sixth and seventh sternites, which are blackish. *Legs* rather stout,

dark brownish, femora somewhat lighter towards the base. *Wings* almost uniformly dark brown. Cell R_2 about three times as long as its stem, the marginal cross-vein placed at about a quarter of the distance between the base and tip of R_2 . First section of M_{1+2} about as long as and almost in a line with the R-M cross-vein; a short stump arising from the junction. Cu_1 meeting M_3 just before the middle of cell 1st M_2 , which is not much longer than broad. *Halteres* black.

Length of body 21 mm.; size of wing 18×5.8 mm.

Taipin, 12. x. 1910 (*T. Shiraki*), 1 ♀.

The nearest ally of this species is *E. scutellata*, Edw., from Ceylon, but the resemblance is not very close. Compare with *Longurio rubriceps*, described below (p. 261).

AMALOPINI.

Rhaphidolabis brunettii, nom. n.

(*Gnophomyia aperta*, Brun. Fauna Brit. Ind., Nemat. p. 492;
nec *G. aperta*, Coq.)

Arisan, 10. x. 1912 (*I. Nitobe*), 1 ♀.

TIPULINÆ.

CTENOPHORINI.

Pselliophora divisa, Brun.

This species was described by Brunetti (Rec. Ind. Mus. vi. p. 242) from a single female from the "East Indies." The British Museum possesses a male from Sikkim, May 1896, 2000 ft. (*J. G. Pulcher*), and a female from Bhutan (purchased from Rosenberg). The male differs from the female in having the hind femora densely clothed with long black hair, a remarkable character for a member of this genus. In both sexes the uniformly red thorax is somewhat shining; the last four abdominal segments and the genitalia are uniformly dull deep black. The *lam. term. inf.* of the male hypopygium is serrate all along its dorsal margin.

Pselliophora speciosa, sp. n.

A male in the British Museum from the Khasi Hills, Assam (purchased from E. Heyne), is evidently allied to *P's. divisa*, particularly in regard to the densely hairy hind femora and the genitalia; it differs, however, as follows:—Thorax uniformly black, considerably shining; fifth abdo-

minal segment rather narrowly red at the base; *lam. term. inf.* of hypopygium of different shape and differently toothed.

Though at first sight this might easily be mistaken for *Ps. ctenophorina*, it differs considerably in the genitalia and also in the shining thorax, the long hair on the hind femora, and the narrow white rings on the tibiæ.

Pseliophora ctenophorina, Riedel.

1 ♂, Kuskus, 25. v. 1908 (*I. Nitobe*); also 1 ♂ in British Museum from Koannania, S. Formosa, 15. vi. 1906 (*A. E. Wileman*).

The Kuskus specimen agrees very well with Riedel's description (*Ent. Mitt.* ii. 1913, p. 274), except that the last joint of the palpi is white with the tip black. In the Koannania specimen the palpi are missing, but the wings are yellowish brown as described by Riedel for the female of *Ps. ctenophorina*. In both these specimens the thorax and the tip of the abdomen are dull black, a point of some importance not mentioned by Riedel.

Pseliophora semirufa, sp. n.

Head velvet-black, antennæ and palpi black (last joint of palpi missing). None of the antennal joints are distinctly enlarged on the underside; the third joint is about as long as the first, the fourth half as long as the third and a little longer than the fifth. *Thorax* uniformly velvet-black. *Abdomen* with the first three segments entirely reddish orange; middle part of fourth sternite and a rather broad narrowly interrupted basal band on the fourth tergite of the same colour; remainder of fourth and the whole of the fifth to eighth segments velvet-black; ninth segment and ovipositor shining black. *Legs* black; hind femora orange on the basal third; front and hind tibiæ with a narrow white band near the base (middle legs missing). *Wings* blackish brown; a yellow area across the bases of the basal cells, divided by the dark veins which cross it; two large somewhat oval yellow spots, almost united, occupying the apical third of the basal cells, the upper one extending into the inner marginal cell; a small yellow streak below Cu_2 ; whitish patches in the centres of cells An and Ax. Cell M_1 just sessile; Cu_1 rather strongly curved downwards at the tip, so that at the wing-margin the cell M_2 is twice as wide as the cell Cu_1 . *Halteres* black, base of stem brownish.

Length of body 17 mm.; wing 17 mm.

Taihoku, xi. 1909 (*I. Nitobe*), 1 ♀.

This species is nearly allied to *Ps. ctenophorina*, Riedel, and *Ps. fumiplena*, Wlk., but is certainly distinct from both; there is a slight structural difference in the antennæ: Riedel describes those of *Ps. ctenophorina* as approaching those of *Prionocera* in structure, the flagellar joints being elongated on the underside; in *Ps. fumiplena* this is true of the third and, perhaps, the fourth joints, though not of the remainder. In regard to coloration, *Ps. semirufa* is also well distinguished; from *Ps. ctenophorina* in the blotched wings and the narrower white rings on the tibiæ; and from *Ps. fumiplena* in the more extensive wing-markings and the greater amount of red on the abdomen. It is worth mentioning in this connection that *Ps. fumiplena* as described by Osten-Sacken appears to consist of three allied species, two of which are briefly characterized below under the names *flavibasis* and *sackeni*.

Pselliophora fumiplena, Wlk.

The British Museum series of this species consists of three males and five females, all labelled "North China"; they were all seen by Osten-Sacken, who quite correctly noted the variability in the wing-markings and in the amount of red on the third and fourth abdominal segments. In all the specimens the legs are black, all the tibiæ carrying conspicuous white subbasal rings; the fifth and following segments of the abdomen are entirely black; the base of the wing is entirely blackish, except in one specimen, which has some rather inconspicuous yellow streaks in this position; the male antennæ are entirely black; the third joint of the female antennæ is rather distinctly produced below towards the tip; the halteres are black.

The pair of bare black plates (*lam. term. inf.?*) visible about the middle of the hypopygium when seen in end-view are produced at their upper and inner corners into a long tooth-like process. In *Ps. flavibasis* and *Ps. sackeni* the hypopygium has an almost identical structure; *Ps. ctenophorina* is very similar, but the tooth-like process is very short, and there are some other differences.

Pselliophora flavibasis, sp. n.

There are three specimens in the British Museum collection: a male from Nagasaki, S. Japan, May 1886 (*Leech*); a female from Lu-huang Island, Chusan Archipelago, May (*J. J. Walker*), and a second female simply labelled "China," which I regard as distinct from *Ps. fumiplena*. Only one of

these specimens, and that the least perfect, was seen by Osten-Sacken. All three show the following differences from Walker's species:—The wings are broadly yellow near the base, the yellow colour extending to about a third of the wing-length along the costa, though not so far along the hind margin; the extreme wing-base, however, remains black; the tibiæ are much more brownish, so that the white rings are much less clearly defined—in fact, in two of the specimens they are practically absent. In the male the femora as well as the tibiæ are for the most part yellowish brown, as is the central axis of the antennæ. The third antennal joint of the female is not distinctly produced below. The wing-markings, apart from the basal yellow patch, are rather more developed than in the most strongly marked specimens of *Ps. fumiplena*. Halteres light brown (♂) or blackish (♀).

Pselliophora sackeni, sp. n.

Two males and a female labelled "China" (*Bowring*) were briefly described by Osten-Sacken (*Berl. ent. Zeitschr.* xxx. p. 171), who somewhat doubtfully regarded them as a variety of *Ps. fumiplena*.

Head dark brownish, with yellowish-brown hair; antennæ reddish, except for the appendages of the male flagellum, which are blackish. *Thorax*: prothorax wholly or partly brownish orange. Mesonotum brownish orange, with a narrow blackish-brown border; scutellum blackish brown. Postnotum mainly brownish orange. Pleuræ blackish brown, with one or two brownish-orange spots. *Abdomen*: first segment black; second to seventh segments each orange with a black triangle on the posterior margin, that on the second segment rather small, the rest larger, and except that on the third segment reaching the anterior margin. Hypopygium mainly brownish orange, the tip blackish. *Legs*: coxæ partly blackish, especially the front half of the hind pair, otherwise brownish orange; femora, tibiæ, and first tarsal joints entirely orange, except their extreme tips, which are blackish; the bases of the tibiæ are somewhat lighter, but without distinct pale rings; remainder of tarsi dark brown. *Wings* as in *Ps. flavibasis*, but the yellow at the base extends halfway along the costa. Halteres rather light brownish.

Brunetti's *Ps. bifascipennis*, described from a female from Shanghai, is evidently related to this species, but has brown stripes on the mesonotum.

TIPULINI.

Tipula shirakii, sp. n.

Head dark slate-grey, a narrow pale margin behind the eyes, lower part of front grey-dusted. Front one-sixth of the width of the head, not in the least swollen above the antennæ. Rostrum and palpi dark brown, black-haired like the occiput. Antennæ barely two-thirds as long as the thorax, thirteen-jointed. First joint brownish towards the base, more ochreous apically, second joint ochreous. Third joint a little more than half as long as the first, light brown at each end, darker in the middle. Joints 4-11 all about equal in length, light brown, the slight basal enlargement blackish brown and bearing three long and one or two short hairs; the long hairs are not much longer than the joint. Twelfth joint two-thirds as long as the eleventh, thirteenth half as long as the twelfth. *Thorax*: pronotum brownish. Præscutum bare, greyish brown, more grey towards the margins, with scarcely perceptible indications of four darker stripes; the entire margin narrowly blackish brown, most noticeably so in front; a pair of small connected blackish-brown spots immediately before the suture in the middle. Scutum greyish brown, bare. Scutellum greyish brown, with short scanty yellowish hairs, and with two rather large and only narrowly separated black spots on its apical half. Postnotum brownish grey, with rather dense, short, yellowish pubescence. Pleuræ ochreous, somewhat darker above; an ill-defined blackish-brown stripe passes from the hind corner of the præscutum, just under the wings and across the hypopleura, connecting the dark margin of the præscutum with the dark lateral abdominal stripe. *Abdomen* dark brown above, a rather broad but ill-defined blackish lateral stripe, indistinct on the last few segments; hind margins of tergites narrowly pale; venter ochreous. Ovipositor normal, shining brown, bare. *Legs* brownish ochreous, tips of femora broadly, of tibiæ and first two tarsal joints narrowly, blackish; last three tarsal joints black. *Wings* light brownish; costal cell and stigma darker brown; a brown spot in cell Cu_2 below the middle of cell M ; a brown cloud in cell M , placed on Cu a little distance before the fork; wing-membrane on each side of the former of these spots and on the basal side of the latter lighter; a larger light patch covering the cell 1st M_2 and extending upwards to the stigma and outwards to the base of the cell M_1 . Veins (except R) quite bare. Rs a little longer than R_{2+3} and about twice as long as R_2 ; stigma

as long as R_{2+3} . R_{4+5} ends either in the wing-tip or just below it. Cell M_1 three times as long as its petiole. Cu_1 in punctiform contact with M_3 . Cell Cu_1 at its tip slightly wider than cell M_3 . Cell Ax rather broad, slightly broadest in the middle. *Halteres* dark brownish, tip of knob lighter.

Length of body 26 mm. ; size of wing 24×6 mm. Length of hind femur 16 mm., hind tibia 18.5 mm. ; first hind tarsal joint 20 mm.

Arisan, 8000 ft., 10. x. 1912 (*I. Nitobe*), 1 ♀ ; also 1 ♀ from Khasi Hills, Assam (purchased from E. Heyne), in British Museum Collection. The latter specimen differs chiefly in that R_{4+5} ends just below instead of at the wing-tip.

This interesting species belongs to the same group as the European *T. fulvipennis*, Deg., and has a considerable resemblance to *T. demejerei*, Edw., recently described from New Guinea. This latter differs in the dark postnotum and broader wings, as well as in other characters. A species described, but not named, by de Meijere (*Tijd. v. Ent.* liv. p. 71) must resemble this species closely, but seems to be different again.

Tipula coquilletti, End.

Arisan, 10. x. 1912 (*I. Nitobe*), 1 ♂.

Agrees quite well with Japanese specimens in the British Museum.

Tipula rufomedia, sp. n. (Pl. XII. figs. 5-7.)

Head velvet-black, rostrum somewhat shining at the sides ; palpi and antennæ dull black, only the second antennal joint somewhat reddish-tinged. Antennæ alike in the two sexes, about as long as the thorax, 13-jointed, but the last joint very small and indistinct ; remaining flagellar joints all about equal in length, oval-cylindrical, with a very slight basal enlargement, and with three long and one or two shorter verticillate hairs, the long hairs being about half as long again as the joints ; pubescence fine, whitish, a little longer on the under surface of the flagellum. First scapal joint rather long, nearly smooth, enlarged apically. Rostrum scarcely as long as the head, nasus well-developed, with rather long black hair. *Thorax* uniformly velvet-black, nearly bare. *Abdomen* with the first segment velvet-black beneath and at the sides, orange above ; second to fifth segments orange-red, black-haired, apical corners of the fifth tergite and an indistinct lateral line on the third and fourth black ; sixth to ninth and genitalia entirely velvet-black.

Ninth tergite of male (fig. 5) broad, pointed, rather shining apically, tip with a single blunt median tooth. Pleurites thick, clothed with dense black hair; claspers (fig. 6) almost hidden by the projecting pleurites. Ninth tergite of female (fig. 7) broadly and deeply emarginate; anal valves very short, fleshy; valves of ovipositor very short. The abdomen in both sexes is short and rather stout, that of the female being rather broader but not longer (in proportion) than that of the male. *Legs* blackish, slender, the first tarsal joints not much longer than the tibiae. *Wings* slightly and uniformly infuscated; stigma distinct, yellowish brown. Tip of R_1 present, but uncoloured. R_s short, less than twice as long as the stigma, twice as long as R_{2+3} or R_2 , and about equal in length to R_3 . R_3 and R_{4+5} nearly straight, the latter ending just above the wing-tip. Basal deflection of R_{4+5} very short, shorter than the R-M cross-vein. Cell M_1 almost parallel-sided, nearly three times as long as its petiole. A short M-Cu cross-vein present. Cell Ax broad, broadest in middle, extended a short distance beyond the base of the basal cells.

Length of body 11 mm.; abdomen 6 mm.; wing, ♂ 15, ♀ 17.5 mm.

2 ♂, Horisha (*M. Maki*); 1 ♀ in British Museum from Formosa (*A. E. Wileman*), without exact locality.

This is one of the most strikingly coloured species of *Tipula* I have seen, and it is surprising that it should not have been described before. Its only near allies seem to be *T. melanomera*, Walk., from Nepal, *T. cinereifrons*, de Meij., from the Malayan region, and the new species described below. Both the former have an entirely reddish thorax. These four species form a very distinct group, distinguished by the short stout abdomen and the remarkable female hypopygium, with its short fleshy anal valves and its very short ovipositor. (The anal valves in most species of *Tipula* form the ensiform appendages, which are usually spoken of as the dorsal valves of the ovipositor.) It might be justifiable to remove these species from *Tipula*; but, as I can see no character, apart from those of the genitalia, on which to base a generic distinction, I refrain from doing so.

Tipula rufizona, sp. n. (Pl. XII. fig. 8.)

A single female specimen in the British Museum Collection from Chin-Fu-San, W. China (*W. A. Maw*), represents a species which is evidently closely allied to *T. rufomedia*, but is certainly quite distinct. It differs from *T. rufomedia* as

follows :—Thorax not entirely velvet-black ; the præscutum with four blackish-grey stripes, separated by three equally broad stripes of the velvet-black ground-colour, the middle pair of grey stripes reaching the front margin and attenuated behind at the suture ; scutum and scutellum dull black without any velvety appearance. The orange colour of the abdomen is confined to the upper part of the first tergite, the whole of the second segment, the middle part of the third sternite, and narrow transverse bands at the bases of the third and fourth tergites. The ninth tergite is much smaller and less deeply emarginate, and the lobes of the ninth sternite (fig. 8) are much larger. Wings and legs as in *T. rufomedia*. Length of body 14 mm. ; wing 17·5 mm.

Longurio rubriceps, sp. n. (Pl. XII. fig. 9.)

Head dull red ; antennæ, palpi, labella, nasus, and sides and under surface of rostrum black. Rostrum very short, only about half as long as the head, nasus as long as the rostrum itself. Front rather swollen above the antennæ. First antennal joint scarcely twice as long as broad ; second globular, a little broader than the first ; third about the size and shape of the second ; fourth and fifth nearly globular, diminishing in size ; remainder slender and clothed with long hairs, the joints ill-defined. *Thorax* uniformly velvet-black, the mesonotum very much arched forwards over the head. *Abdomen* : first segment velvet-black, with a reddish area near the tip ; second orange, narrowly black at the base and apex ; third, fourth, and fifth orange, with a narrow black apical margin ; sixth black, orange on the basal third ; seventh, eighth, and genitalia (fig. 9) velvet-black. *Legs* : coxæ velvet-black ; trochanters dark brown ; rest of legs yellowish brown, the tarsi and the tips of the tibiæ darker. Tibial spurs apparently absent ; tarsi very long and slender, the first joint nearly twice as long as the tibiæ. *Wings* blackish brown ; a small clear streak in the upper basal cell and another in the cell An. Stigma oval, rather darker than the ground-colour. Sc₁ present, but rather slender, nearly vertical. Rs nearly twice as long as the stigma, and a little longer than R₂₊₃, which, in its turn, is just over twice as long as R₂. Cell M₁ petiolate, a little longer than its petiole. Cu₂ in punctiform contact with M₃. *Halteres* black.

Length of body 17 mm. ; wing 16 mm. ; hind femur 11 mm. ; hind tibia 11 mm. ; first hind tarsal joint 21 mm. ; remainder of hind tarsus 8 mm.

The two previously described species of this genus are both

from the North-American continent. The new species differs from *L. minimus*, Alex., in coloration, in the longer radial sector, and in the absence of a distinct M-Cu cross-vein; it resembles Alexander's species in the long petiole of the cell m_1 .

The coloration of this species is so very different from that of a normal Tipuline, and so remarkably like that of *Eriocera rubriceps* (described above, p. 253), that it is almost impossible to believe that the resemblance between these two can be merely accidental. Possibly both may be mimics of a hymenopteron.

Shinten, 400 ft. (*T. Shiraki*), 1 ♂.

Longurio fulvus, sp. n.

The British Museum possesses two females of another very distinct species of *Longurio* from North China (Coll. Fortune, purchased from Stevens in 1856). It will be convenient to describe them here under the above name.

Body wholly dull orange-ochreous, with the following exceptions:—Palpi black; flagellum of antennæ dark brown; last abdominal segment and ovipositor black; a rather narrow interrupted black median line on the venter; legs dark brownish; wings brownish-tinged, but not so dark as those of *L. rubriceps*, hence the stigma is more conspicuous. Structural characters very similar to those of *L. rubriceps*, but the third, fourth, and fifth antennal joints are more oval; Sc_1 is more oblique, the cell M_1 is about twice as long as its petiole; and the tarsi are not quite so long (this last character may vary with sex). In one specimen Cu_1 is just in contact with M_3 , in the other a distinct M-Cu cross-vein is present.

Length of body 18 mm.; wing 18 mm.; hind tibia 11 mm.; first hind tarsal joint 18 mm.

BRITHURA, gen. nov. (Pl. XII. figs. 10-12.)

Antennæ not longer than the thorax, 13-jointed, the flagellar joints with long verticillate hairs at the base, two above and one below. Rostrum as long as the head, with distinct nasus. Fourth palpal joint thin, as long as second and third together. Front with a sharp-pointed conical elevation just above the antennæ. Body very stout; ninth abdominal tergite in the male turgid, claspers rather narrow, twisted, projecting beyond the ninth tergite and conspicuous from above. Legs not greatly elongated, first tarsal joints considerably shorter than the tibiæ; femora without apical comb; claws with a small tooth near the base; empodia well developed. Wings broad; a slight projection on the costa above the stigma, a

distinct though shallow emargination at the apex of Cu_2 ; anal extended some way beyond the base of the basal cells. Sc_1 distinctly reaching costa; Sc_2 short, oblique, near tip of Sc_1 . Rs rather short; R_2 present; R_3 nearly straight; R_{4+5} curved downwards, ending below the tip of the wing. $R-M$ cross-vein absent or quite short. Cell 1st M_2 pentagonal; cell M_1 petiolate, the petiole hardly half as long as the cell.

Genotype, *Brithura conifrons*, sp. n.

This genus is distinguished from *Tipula* chiefly on account of the presence of Sc_1 , which terminates distinctly in the costa. The combination of a number of other minor peculiarities gives the insects a very distinct facies. The venational character of the presence of Sc_1 is not found, so far as I am aware, in any species of *Tipula* or in the related genus *Ctenacroscelis*; it does occur, however, in a number of species of *Holorusia* and *Macromastix*, but these genera are, in my opinion, less closely related to *Tipula*, since they are devoid of verticillate hairs on the antennæ.

Brithura conifrons, sp. n. (Pl. XII. figs. 10 & 11.)

Head dark velvet-brown, a light V-shaped mark between the frontal cone and the base of the antennæ; some short dark hairs above and long ones below. Rostrum uniformly dark brown. Palpi blackish, third joint lighter. Antennæ: first joint elongate, dark brown, black-haired; second joint cup-shaped, lighter brown, bare. Third joint nearly cylindrical, contracted at the base, blackish, about half as long as the first. Remaining flagellar joints (except the last two) all nearly equal in length to the third, dorsal surface straight, with a slight basal enlargement, ventral surface evenly convex; pubescence very fine, not more than one-sixth as long as the width of the joints; the three long verticillate hairs are almost three times as long as the joints, and there are, in addition, one or two shorter hairs at the base of each joint on the inner side. Twelfth joint a little shorter than the eleventh, thirteenth more than half as long as the twelfth; the hairs on these two joints all about equal in length. *Thorax* almost uniformly dark velvet-brown; mesonotum with three lighter brown stripes; front edge of hypopleuræ silvery grey when seen from behind. Scutellum, postnotum, and sides of præscutum rather thickly clothed with dark hair. *Abdomen* dark brown, slightly shining, hind corners of tergites grey; pubescence short, black; eighth and ninth segments and genital appendages wholly orange, with orange pubes-

cence, which is very dense on the eighth sternite and at the tip of the pleurite. The hypopygium (fig. 10) is very little wider than the rest of the abdomen and about as long as the sixth and seventh segments combined. *Legs* rather light brownish, tarsi darker, femora with a dark brown ring a little before the tip. *Wings* (fig. 11) with the ground-colour rather dark brownish grey; costal cell and area round the stigma yellowish; stigma rounded, blackish; a small spot over the base of Rs; a dark cloud over and surrounding the cell 1st m_2 . Pale markings distributed as follows:—A patch near the tip of the upper basal cell; a mark shaped something like the figures 80 conjoined occupying the apical half of the lower basal cell; a small spot near the base of cell Cu_2 ; small streaks along An and Ax near their tips; a spot in cell R_3 connected with a larger one in cell R_{4+5} ; small spots on the wing-margin in cells R_{4+5} , 2nd M_2 , M_3 , and Cu_1 , and two in cell An. Rs gently curved, as long as R_2 ; marginal cross-vein joining R_{2+3} just before the fork; R-M cross-vein absent, R_{4+5} being fused with M_{1+2} for a short distance; M-Cu cross-vein present, but very short. *Halteres* with rather light brown stem; basal half of knob black, apical half dark grey.

Length of body 21 mm.; abdomen 12.5×2.5 mm.; wing 17.5×5 mm.

Arisan, 8000 ft., 10. x. 1912, 1 ♂ (*I. Nitobe*).

Brithura crassa, sp. n. (Pl. XII. fig. 12.)

I take this opportunity of describing under this name a single male specimen in the British Museum Collection which was purchased from Stevens in 1852 and is simply labelled "East Indies" (*i. e.*, India?). It differs from *B. conifrons* as follows:—Thirteenth antennal joint only one-third as long as the twelfth. Thoracic dorsum with the stripes scarcely perceptible, almost as dark as the ground-colour. Abdomen rather longer in proportion, the tergites darker laterally; hypopygium (fig. 12) dark brown like the rest of the abdomen, much longer than in *B. conifrons*; a remarkable downwardly projecting organ (?ninth sternite) on the under-side; there is some orange hair at the base of the claspers, though not on the pleurite. Wing-markings similar, but there is no definite dark cloud over the discal cell; there is only a <-shaped mark in the lower basal cell, the apex of the < pointing towards the base of the wing; the pale spots along the wing-margin are rather more distinct, and there is an additional one present in the cell M_1 . Rs half as long

again as R_2 ; marginal cross-vein joining R_2 near its base; R-M cross-vein distinct, but rather short; Cu_2 just in contact with M_3 . Costal hump rather more prominent.

Length of body 31 mm.; abdomen 21 mm.; wing 24 mm. Breadth of abdomen 3 mm.; hypopygium 4.2 mm.; wing 24×7 mm.

The wing-markings of this species resemble those of *Tipula thibetana*, de Meij., rather closely, but from de Meijere's description and figures it is clear that his species is a true *Tipula*.

Pachyrrhina citrina, sp. n.

Head dull orange-yellow, a small vertical triangle and a very small spot at the upper corner of each eye dull brownish black; a patch on the upperside of the rostrum, including the nasus, brownish black, rather shining. Palpi dark brownish. Antennæ ochreous, the last seven or eight joints brownish; flagellar joints nearly cylindrical, with dark hairs, the first two joints without long hairs beneath, remainder with one. Thorax with the ground-colour dull lemon-yellow; pleuræ, scutellum, and postnotum unmarked. The three stripes on the præscutum shining leaden-black, narrowly bordered with velvet-black; the median stripe much broadened anteriorly and reaching the front margin; lateral stripes with a downwardly-bent portion in front which is velvet-black. A pair of velvet-black marks on the suture connecting the lateral stripes of the præscutum with a pair of large, shining, leaden-black spots on the scutum, which are velvet-black at each end. Pronotum with a small brownish mark at each side. Abdomen ochreous, with a broad, uninterrupted, though rather ill-defined blackish median stripe and narrower black lateral stripes; first segment wholly ochreous, seventh and eighth wholly blackish; ovipositor shining ochreous. Legs dingy brownish, tibiæ and tarsi darker. Wings with very slight greyish tinge; stigma light brownish, including a small patch of minute hairs; costal cell between Sc_1 and the stigma yellowish. Sc_1 present, but indistinct. Tip of R_1 very indistinct. Rs normal, equal in length to the stigma or to R_{2+3} or R_2 . Basal deflection of R_{4+5} twice as long as and in a line with the M-Cu cross-vein. Cell 1st M_2 normal, elongate, the cross-vein closing it joining M_2 a very short distance beyond the fork.

Taihoku (*T. Shiraki*), 1 ♀.

This is apparently the species described, but not named,

by de Meijere (Tijd. v. Ent. liv. p. 77, 1911). It is also nearly allied to *P. consimilis*, Brun., but seems to be distinct.

Pachyrrhina virgata, Coq.

Arisan, 8000 ft., 10. x. 1912 (*I. Nitobe*), 2 ♀.

There are some divergences from Coquillett's description which are probably due only to the difference of sex, Coquillett describing only the male. The female has been recorded, but not described, by Alexander (Can. Ent. xlv. p. 163). In the present specimens the abdomen is mainly dark brown above, the base and apex of the first segment, the ovipositor, the whole venter, and the margins of the tergites, especially towards the base of segments 2-4, being yellowish. In one specimen the dull brown spot at the tip of the lateral thoracic stripe is distinct, making the stripe appear bent downwards at the tip; in the other it is not distinctly so; this species would therefore seem to connect the group in which the lateral stripe is bent with that in which it is not.

Pachyrrhina javensis, Dol.

A male from Kotosho Island, near Formosa, 20. vii. 1912 (*T. Shiraki*).

Osten-Sacken and Brunetti have both referred to the small size of the discal cell as one of the distinguishing characters of this species. It may also be noted that in the present specimen and in a male from Trincomali, Ceylon (*Lt.-Col. Yerbury*), the radial sector is extremely short, shorter even than the descending portion of R_{4+5} , and only about half as long as the stigma. In some females from Ceylon which I refer with a certain amount of doubt to this species, the venation is similar except that R_s is not quite so short. In all these specimens a noteworthy feature, previously overlooked, is that the stigma is devoid of hairs. As in most of the species of this genus, Sc_1 is present, though shorter than Sc_2 ; the area of the costal cell between Sc_1 and R_1 is in this species concolorous with the dark stigma.

Pachyrrhina parva, sp. n.

Head entirely orange; upper surface of rostrum shining; front considerably swollen. *Antennae* a little longer than the head and thorax together, 13-jointed, the last joint minute; scape and first flagellar joint orange, remainder dark brown. Intermediate flagellar joints with well-marked basal enlargement and median emargination on the underside, upperside

slightly concave; pubescence nearly as long as the width of the joint. Palpi yellow. *Thorax*: pronotum entirely dull orange. Præscutum dull orange-ochreous, with the usual three shining stripes; the middle part only of these stripes is blackish, the dark colour shading off gradually into the orange ground-colour; there is, however, a sharply defined edge to the shining parts. The dark colour of the median stripe barely reaches the front margin. Scutum shining orange-ochreous, the usual dark spots absent; a black mark just above and in front of the root of the wing, extending a short distance along the suture. Scutellum and postnotum entirely shining orange-ochreous; pleuræ uniformly orange-ochreous, slightly shining. *Abdomen* almost entirely orange-ochreous, the only dark marking being an ill-defined blackish streak on the lateral margins of the second, third, and fourth tergites. *Legs* yellow, tarsi dark brown, tips of femora and tibiæ narrowly black. *Wings* almost hyaline, stigma no darker, devoid of hairs. R_s , R_{2+3} , and R_2 all about equal in length, descending portion of R_{4+5} not much shorter. Discal cell normal. Cell M_1 petiolate. *Halteres* ochreous.

Length of body 8.5 mm.; wing 8 mm.

Arisan, 8000 ft., 10. x. 1912 (*I. Nitobe*), 1 ♂.

A very distinct species, owing to the small size and the unusual thoracic marking.

Pachyrrhina formosensis, sp. n.

Head missing. *Thorax* almost uniformly brownish ochreous, not particularly shining; the only dark marking is a blackish streak on each lateral margin of the scutum just above and in front of the wing-root. *Abdomen* dull yellow-ochreous, with broad median and narrow lateral black stripes. The median stripe extends almost continuously along segments 2-7, broadening out slightly on the posterior margins and being only narrowly interrupted near the bases of segments 2 and 3, segments 1 and 8 being entirely pale above. The lateral stripe extends from segments 1-8, is of even width throughout, and is narrowly interrupted behind the middle of segment 2 and before the middle of segments 3-6. Ovipositor brownish ochreous. *Legs* ochreous, tips of femora and tibiæ indistinctly darker, tarsi brownish. *Wings* slightly brownish-tinged, the stigma and the subcostal cell (but not the costal) dark brown; also an ill-defined brown margin to the apical part of the wing; a rather inconspicuous pale spot on each side of the stigma, which bears a few hairs; descending portion of R_{4+5} dark-margined and very

oblique. Sc_1 incomplete. Rs equal in length to R_2 , a little shorter than R_{2+3} , which in its turn is a little shorter than the stigma. Cell M_1 sessile. Cell 1st M_2 of the normal elongate shape. Cu_1 fused with M for some distance, but leaving it again before the fork. Cell Cu_1 at tip not much narrower than cell M_3 . *Halteres* light brownish.

Length of thorax and abdomen 14.5 mm.; wing 14 mm.

Kammōtu, 10. iv. 1910, 1 ♀ (*I. Nitobe*).

Although this specimen lacks the head, it seems worth while to describe it, owing to several peculiarities of coloration and one of venation—the fusion of Cu_1 with M. *P. palloris*, Coq., has a very similar wing, but in that species the costal cell is dark and the thorax is distinctly striped, the lateral stripes having a velvet-black spot on each side of their anterior ends. *P. immaculata*, Wulp, has not been adequately described, but apparently differs in being of smaller size and in having the legs dark and last two abdominal segments black.

Pachyrrhina sinensis, sp. n.

A female specimen in the British Museum from N. China (*Fortune*) representing another new species allied to *P. palloris*, Coq., and *P. formosensis* may be described here.

Head dull orange; a small, triangular, shining, light brown spot on the vertex; rostrum shining brown, somewhat darker above. Palpi brownish. Scape of antennæ orange (flagellum missing). *Thorax*: pronotum dull, orange in the middle, brown at the sides. Mesothorax with the entire surface slightly shining, the postnotum more so. Præscutum brownish ochreous, with four darker brown stripes, the middle pair just connected in front of the suture, rather lighter in colour and less well-defined than the lateral pair. Scutum rather dark brownish, lighter in the middle, a velvet-black streak on each lateral margin, just in front of the wing-base, continued narrowly nearly halfway along the suture. Scutellum yellowish brown. Postnotum pale in the middle, brown at the sides. Pleuræ mainly pale ochreous; a rather broad but ill-defined brown stripe runs from the lateral stripe of the præscutum to the middle coxæ. *Abdomen* moderately shining, brownish ochreous; first segment dark above; segments 2–6 with large blackish-brown triangles on the posterior margin, second segment also with a brown spot near the base; hind margins of segments 7 and 8 narrowly brownish; blackish lateral stripes as in *P. formosensis*, except that they are rather broadly interrupted at the base of

the eighth segment. *Legs* as in *P. formosensis*. *Wings* as in *P. formosensis*, except that the base and the costal cell, as well as the subcostal, are dark brown; there is no pale spot beyond the stigma; the ascending part of Cu_1 is dark-margined, and the cell M_1 is shortly petiolate.

EXPLANATION OF PLATE XII.

- Fig. 1.* *Dicranomyia alticola*, sp. n. Apex of ♀ abdomen, side-view (from balsam preparation). $\times 35$.
Fig. 2. *Gnophomyia similis*, sp. n. Apex of ♀ abdomen, side-view (from dry specimen). $\times 35$.
Fig. 3. *Limnobia nitobei*, sp. n. ♂ hypopygium from below. $\times 35$.
Fig. 4. *Erioptera alboguttata*, sp. n. ♂ hypopygium from below. $\times 35$.
Fig. 5. *Tipula rufomedia*, sp. n. ♂ hypopygium from below. $\times 10$.
Fig. 6. Ditto. ♂ right clasper, inner side-view. $\times 23$.
Fig. 7. Ditto. Tip of ♀ abdomen from below. $\times 10$.
Fig. 8. *Tipula rufizona*, sp. n. Tip of ♀ abdomen from below. $\times 10$.
Fig. 9. *Longurio rubriceps*, sp. n. ♂ hypopygium from above (penis removed). $\times 13$.
Fig. 10. *Brithura confrens*, gen. et sp. n. Tip of ♂ abdomen, side-view (dry specimen). $\times 5.5$.
Fig. 11. Ditto. Apical half of wing. $\times 4$.
Fig. 12. *Brithura crassa*, sp. n. Tip of ♂ abdomen, side-view. $\times 5.5$.

XXIX.—*Descriptions of Eight new Species of Marine Mollusca from the South Shetland Islands.* By H. B. PRESTON, F.Z.S.

[Plate XIII.]

THE thanks of the author are due to Mr. A. G. Bennett, of the Falkland Islands, for the material described in the present short paper; when the difficulties of collecting in what is (even in the height of summer) an exceptionally rigorous climate, in great discomfort and without adequate apparatus, are taken into consideration, it will be readily appreciated how much Mr. Bennett was able to accomplish during his short stay at Deception Island in the summer of 1913-14.

Limacina costulata, sp. n. (Fig. 1.)

Shell discoidal, almost planulate above, with slightly exerted apical whorls, extremely thin, white, vitreous, transparent; whorls 4, the last large and produced below, *transversely costulate*: umbilicus deep, showing the coiling of the whorls; aperture broadly auriform.

Alt. 4, diam. maj. 6, diam. min. 4·5 mm.

Aperture: alt. 3·75, diam. 2 mm.

Hab. From the stomachs of fish taken in Bransfield Straits, South Shetland Islands (*A. G. Bennett*).

Lunatia bransfieldensis, sp. n. (Fig. 2.)

Shell perforate, ovate, rather basally elongated, whitish; whorls $3\frac{1}{4}$, the last large, descending in front, smooth; suture impressed; umbilicus narrow, deep; columella margin descending obliquely, then rather sharply curved and very obliquely descending in the opposite direction, extending above into a thickish, white, well-defined, parietal callus, which recedes in its median part to form a very broad sinus; labrum simple; aperture ovate; operculum concave, corneous, shining, laminiferous, three-whorled, with excentric nucleus.

Alt. 8, diam. maj. 7·75, diam. min. 6·25 mm.

Alt. 6·25, diam. 4 mm.

Hab. From the stomachs of fish, taken in 15 fathoms, Bransfield Straits, South Shetland Islands (*A. G. Bennett*).

Lævilitorina claviformis, sp. n. (Fig. 3.)

Shell subcorneous, perforate, turbinately fusiform, reddish brown; remaining whorls 4, the first three regularly increasing, the last very rapidly so, convex, smooth but for transverse growth-lines; suture impressed; umbilicus very narrow, appearing as a narrow fissure; columella margin descending in an oblique curve, very slightly outwardly reflexed, extending above into a thick, restricted, well-defined, parietal callus, which unites it with the upper margin of the labrum; labrum very narrowly outwardly dilated; aperture rather roundly ovate, large for the size of the shell; operculum horny laminiferous, paucispiral, with excentric nucleus.

Alt. 4, diam. maj. 2·75, diam. min. 2 mm.

Hab. On rocks at low water inside Deception Harbour, South Shetlands (*A. G. Bennett*).

Mr. Bennett collected a large number of this form, all of which have lost their extreme apices through erosion; it is a very variable species both in general shape and in the colour of the interior of the shell, which in some specimens is of a lilac-colour, while in others it is of an olive-green or brown hue.

Pellilitorina bennetti, sp. n. (Fig. 4.)

Shell small, imperforate, subcorneous, ovate, reddish

brown; whorls 3, rapidly increasing, the last very large, smooth but for lines of growth; suture impressed; columella margin almost vertically descending in a very slight curve, angled towards the base; labrum simple; aperture roundly ovate, gaping, large for the size of the shell.

Alt. 2, diam. maj. 2, diam. min. 1.75 mm.

Hab. Bransfield Strait, South Shetland; washed from sea-weed from a depth of 15 fathoms (*A. G. Bennett*).

Pellilitorina bransfieldensis, sp. n. (Fig. 5.)

Shell ovate, subcorneous, perforate, dull purplish brown, polished, shining; whorls $3\frac{1}{2}$, rapidly increasing, smooth; suture impressed; umbilicus moderately wide, deep; columella margin rather obliquely descending in a gentle curve, spreading above into an ill-defined parietal callus; labrum simple; aperture ovate, wide, large for the size of the shell; operculum horny, three-whorled, with subcentral nucleus.

Alt. 5, diam. maj. 5.5, diam. min. 4.25 mm.

Aperture: alt. 4, diam. 3.5 mm.

Hab. From stomachs of fish taken in Bransfield Straits off Deception Island, South Shetlands (*A. G. Bennett*).

Limatula deceptionensis, sp. n. (Fig. 6.)

Shell small, ovate, white, finely concentrically striate, and sculptured longitudinally in the median part with from ten to twelve fine costulae, which become obsolete and finally disappear altogether on either side, in which parts the shell shows traces of oblique, distant, radiate striae; umbones rather small, prominent; auriculae of about equal form and size; dorsal margin very gently arched; ventral margin rounded; anterior side abruptly descending, very gently rounded; posterior side a little less abruptly descending and more rounded.

Long. 5.5, lat. 4.5 mm.

Hab. Dredged inside Deception Harbour, South Shetlands, in 6 fathoms (*A. G. Bennett*).

Lissarca bennetti, sp. n. (Figs. 7, 7 a.)

Shell differing from *L. rubrofusca*, Smith*, from Kerguelen, in its darker colour, it being of a dark purplish tint, in its rather more produced anterior side, and broader posterior

* Phil. Trans. Roy. Soc. 1879, vol. clxviii. p. 19, pl. ix. fig. 17.

side; the general inflation of the shell is more evenly distributed throughout than is the case in *L. rubrofusca*, and the crenulation of the ventral margin is, in places, either obsolete or non-existent.

Long. 3.25, lat. 4.25 mm.

Hab. From the stomachs of fish taken in Bransfield Straits, South Shetland, in 15 fathoms (type); also washed from sea-weed dredged in the same locality and at the same depth (*A. G. Bennett*).

Tellimya flavida, sp. n. (Fig. 8.)

Shell rectangularly and obtusely cuneiform, covered with a yellow periostracum; both valves concentrically striate; umbones much eroded; dorsal margin slightly arched; ventral margin very gently rounded; anterior side abruptly descending, very slightly rounded; posterior side obtusely rounded; right valve furnished with two broad grooves to receive the terminal portions of a slightly oblique, short, projecting, anterior and a more elongated, less oblique, posterior cardinal tooth in the left valve, these teeth being situated one on either side of the internal ligament.

Long. 2, lat. 2.75 mm.

Hab. From the stomachs of fish taken in Bransfield Straits, South Shetland Islands, at a depth of 15 fathoms (*A. G. Bennett*).

EXPLANATION OF PLATE XIII.

- Fig. 1. *Limacina costulata*, sp. n., $\times 6$.
 Fig. 2. *Lunatia bransfieldensis*, sp. n., $\times 4$.
 Fig. 3. *Lævilitorina claviformis*, sp. n., $\times 8$.
 Fig. 4. *Pellilitorina bennetti*, sp. n., $\times 10$.
 Fig. 5. — *bransfieldensis*, sp. n., $\times 4$.
 Fig. 6. *Limatula deceptionensis*, sp. n., $\times 6$.
 Figs. 7, 7a. *Lissarca bennetti*, sp. n., $\times 6$.
 Fig. 8. *Tellimya flavida*, sp. n., $\times 10$.

XXX.—Some Dental and Cranial Variations in the Scotch Wild Cat (*Felis sylvestris*). By R. I. POCCOCK, F.R.S.

The Presence of Extra Premolars.

In Felidæ the normal first upper premolar, pm^2 of the typical mammalian series, is very variable in occurrence. In some groups of related species it is practically constantly present;

in others it is equally constantly absent; in others it may be absent or present within the limits of the same species. When present it is, except in the case of *F. planiceps*, a small or very small tooth, reduced in size to give depth to the penetration of the upper canine, and is probably functionless or nearly so.

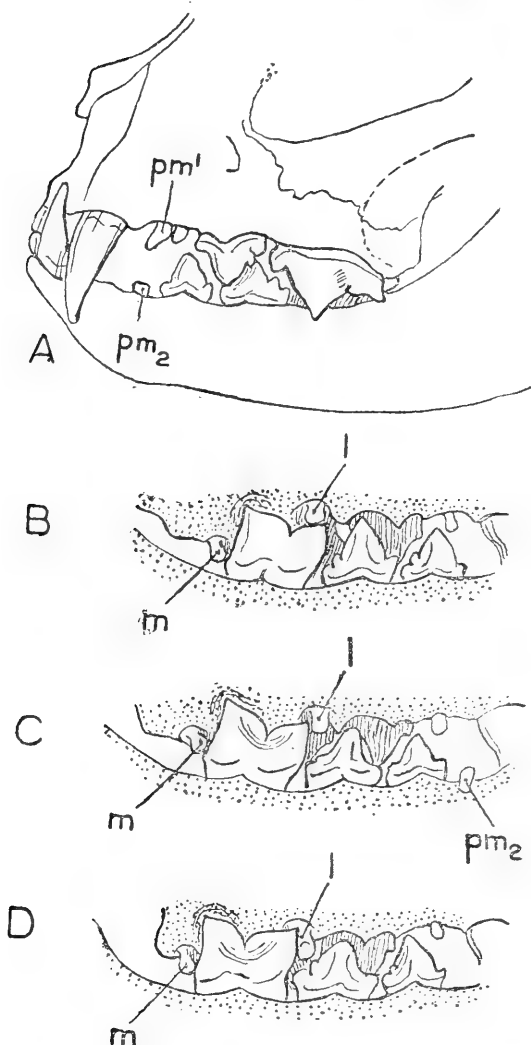
The suppression of pm^2 of the lower jaw to give depth to the penetration of the lower canine has been carried a stage further—almost, indeed, to completion,—only a comparatively few instances of its presence having been observed.

The reduction in size or suppression of these premolars leaves primarily a longish postcanine diastema; and the depth of this is frequently increased by the emargination of the alveolar border which formerly carried the teeth, and not infrequently by the elevation of the anterior portion of the mandible carrying the canines and incisors. The presence of this diastema must, I think, be regarded as a primitive feature. Hence its suppression by the shortening of the jaws resulting in juxtaposition between the canines and the first large premolars (pm^3) above and below, such as has taken place in *Acinonyx* (*Cynailurus*), must be interpreted as a derivative feature.

In Bateson's 'Materials for the Study of Variation,' pp. 223–224 (1894), there are records of the presence of an additional anterior upper premolar on one or both sides in an example of *F. pardus*, *F. eyra*, of *F. sylvestris*, quoted as *catus*, from Athens, and of several domestic cats, quoted as *domestica* and *caligata*. Also there are records of an additional anterior lower premolar on one or both sides in an example of *F. concolor*, of *F. sylvestris* or *ocreata*, of *F. sylvestris*, and of a few domestic cats. To these must be added a reference, overlooked by Bateson, to the occurrence of the extra lower premolar in an example of *F. tigris* (Lydekker, J. A. S. Bengal, xlvii. pt. 2, pp. 2–3, pl. ii., 1878).

In a series of eleven skulls of *F. sylvestris*, all from Inverness-shire or Ross-shire, in my possession, no fewer than four—that is to say, over 33 per cent.—have an additional anterior lower premolar, three showing it on both sides and one on the right side only; and in one skull of the former category of three there is an additional anterior upper premolar on the left side.

In all the skulls of other species of Felidæ belonging to the Zoological Society, only one has an extra premolar—namely, a skull of *F. wiedi* (*macrura*),—which exhibits it on the left side above. The rest, of which in some cases there are tolerably large series—i. e., eleven of *F. pardus*,



Variations in the dentition of *Felis sylvestris*.

- A. Jaws showing the presence of pm^1 in the maxilla and of pm_2 in the mandible.
- B, C, D. Cheek-teeth of three examples, drawn from the buccal side, showing differences in the interlocking of the carnassials; bony areas of mandible and maxilla dotted. l , inner lobe of upper carnassial in three positions; m , inner end of upper molar abutting against the suppressed talon of the lower carnassial. In C pm_2 of the mandible is retained.

eight of *F. pardalis*,—there is no trace of supplementary premolars either above or below.

From the data available to me it seems, therefore, that the development of accessory anterior premolars is a much commoner feature in *F. sylvestris* than in any other species of Felidæ; and, considering the closeness of the relationship between that species and domestic cats, I am disposed to attribute the occurrence of accessory anterior premolars in domestic cats to their kinship with *F. sylvestris*, and to dissociate it altogether from any alleged effects of domestication. Furthermore, it appears to me that the comparative frequency of the presence of these supernumerary teeth—at all events, in the mandible in *F. sylvestris*—justifies the view that the character is not accidental, but is of atavistic significance.

In the skull of *F. sylvestris* above referred to as possessing two premolars in the postcanine space of the left maxilla the two teeth are set close together in distinct alveoli, are one-rooted and simple-crowned. The posterior of the two, which is much too large to be regarded as the corresponding tooth of the milk-series, is the counterpart of the single little premolar of the right side, and seems clearly to be pm^2 of the permanent set. The tooth in front of it is both longer and thicker and has a more conical crown. Until evidence to the contrary is forthcoming, this tooth may be regarded as pm^1 (text-fig. A, pm^1).

In the example of *F. wiedi* (*macrura*) with two small premolars also on the left side in the postcanine space of the maxilla the sizes of the teeth are reversed, the anterior of the two being smaller than the posterior. But here, again, the posterior is the counterpart in size and shape of the little anterior premolar of the opposite side, and appears certainly to be pm^2 of the permanent set. But the anterior of the two, although the smaller, is too large to be interpreted as the retained milk-predecessor of the tooth behind it.

In the four skulls of *F. sylvestris* with the small anterior premolar in the mandible these extra teeth are in size and shape very similar to the small upper premolars (pm^2) of the maxillæ. It is especially to be noted that they are placed with absolute symmetry in all four skulls*, in front of and close to but a little on the inner side of the succeeding tooth. Their distance from the latter varies slightly individually, but not more so than pm^2 of the maxilla varies in position in individual skulls. Provisionally, at all events, I think these

* In the skull with this tooth missing on one side, the original position of the tooth is marked by the scar of its closed alveolus.

extra teeth may be interpreted as pm^2 of the mandible—a tooth which is typically missing in Felidæ (text-figs. A, C, pm_2).

The Interlocking of the Carnassials.

In the Felidæ, as a rule, the upper carnassial is provided with an anterior cuspidate lobe projecting inwards towards the middle line of the palate. This lobe varies considerably in size even in closely related forms, and in some cases, as in *F. manul*, is reduced to a more vestigial stage even than in *Acinonyx* (*Cynailurus*) *jubatus*, where it is generally described as absent. In neither of these species, so far as I am aware, does it ever carry a cusp, and in both of them the anterior blade of the lower carnassial slides over the position this lobe occupies when present in other cats. When this lobe is present and of large size, the blade in question of the lower carnassial typically passes behind it when the mouth is closed.

These facts suggest that the reduction of the inner lobe and of its cusp are modifications that have arisen in connection with a slight alteration in the relative positions of the carnassials either by movement of the teeth themselves or by requisite changes of the upper or lower jaws, enabling the anterior blade of the lower carnassial to slide over practically the whole depth of the enlarged fore part of the upper. Similarly, the suppression or reduction of the talon or third cusp of the lower carnassial enables the whole of the large cutting-blade of that tooth to pass along the inner side of the posterior portion of the upper carnassial without obstruction from the upper molar. It would be incorrect, in my opinion, to say that the cusps in question have been actually worn off by the action of the appropriate opposed teeth; but that would be the Lamarckian inference to be drawn from the observed facts. At all events, the removal of these cusps gives the greatest possible value to the cutting action of the carnassials in the cats, just as the removal of the anterior premolars increases the depth of penetration of the canines.

That the mutual fitting of the carnassials is not to be trusted absolutely as a systematic character in *Felis* is shown by its inconstancy in my series of *F. sylvestris* from Scotland. In one specimen (fig. B, *l*) the anterior blade of the lower carnassial closes upon the summit of the inner lobe of the upper, a condition representing the theoretical stage precedent to the suppression of the lobe in *F. manul* and *A. jubatus*.

In another (fig. C, *l*) the point of the anterior blade passes just behind the apex of the lobe. In a third the blade slides altogether behind the lobe, so that the latter practically reaches the posterior cusp of the last premolar, blocking the space between it and the carnassial, as is typically the case in species of *Felidæ* in which the lobe of the upper carnassial is well developed (fig. D, *l*).

Fronto-squamosal Junction.

In a series of twelve skulls of *F. bengalensis* the frontal bone is separated from the squamosal by a bridge formed by a downward process from the parietal meeting the upper end of the alisphenoid. This appears to be the general rule in the *Felidæ*. In an example of *F. manul*, however, the parietal is excluded from the alisphenoid by the junction of the frontal with the squamosal. One would, perhaps, be inclined to regard this character as a useful and reliable systematic point, were it not that in *F. sylvestris* the junction of the bones at this point is a highly variable feature. Sometimes there is a tolerably broad parieto-alisphenoid bridge between the frontal and squamosal. At other times the bridge is quite narrow; at others it is obliterated altogether by the union of the frontal and squamosal.

XXXI.—*Notes on Fossorial Hymenoptera*.—XXIII. *On some Australian Genera*. By ROWLAND E. TURNER, F.Z.S., F.E.S.

Family *Crabronidæ*.

Subfamily *PHILANTHINÆ*.

Cerceris gilberti, sp. n.

♀. Nigra; mandibulis basi, clypeo, scapo, fronte sub antennis, macula magna pone oculos, pronoto macula magna utrinque, tegulis, scutello linea transversa, postscutello pedibusque flavis; flagello, segmentis dorsalibus secundo basi, tertio quintoque, segmentisque ventralibus secundo, tertio, quinto sextoque brunneo-aurantiacis; clypeo lamina libera, porrecta, brevi, apice emarginata; mesopleuris haud dentatis; segmento mediano area basali

basi oblique striata; alis hyalinis, apice leviter infumatis, venis fuscis, stigmatibus testaceo.

Long. 10 mm.

♀. Clypeus with the lamina free from the base, short and broadly emarginate at the apex; the apical margin of the clypeus below the lamina broadly truncate. The whole dorsal surface and the mesopleuræ closely and rather coarsely punctured; antennæ inserted about half as far again from the anterior ocellus as from the base of the clypeus; second joint of the flagellum slightly longer than the third. Pronotum rounded at the anterior angles; enclosed area of the median segment obliquely striated at the base, opaque, and microscopically punctured at the apex. First abdominal segment more than half as broad again as long; pygidial area twice as long as broad, broadly truncate at the apex, the sides almost parallel.

Hab. Mackay, Q. (*G. Turner*).

One female only.

I had overlooked this species until lately, though the specimen has been in my collection for many years. It is nearly allied to *C. opposita*, Sm., but differs much in colour; the lamina of the clypeus is broader and more deeply emarginate; the striation of the enclosed area of the median segment is confined to the basal half; the petiole is narrower and the pygidial area much broader.

Subfamily *ARPACTINÆ*.

Miscothyris perlucidus, sp. n.

♀. Nigra; mandibulis basi, clypeo, pronoto, mesopleuris macula sub alis, scutello macula magna, postscutello fascia transversa, segmento dorsali secundo fascia angusta apicali lateribus dilatata, segmentisque dorsalibus 3-5 fascia angusta apicali flavis; flagello apice infuscato, tegulis, callis humeralibus, pygidio, femoribus apice, tibiis tarsisque brunneo-testaceis; alis hyalinis, leviter infumatis, venis fuscis.

♂. Feminæ similis; segmento dorsali sexto apice flavo-fasciato; septimo flavo.

Long., ♀ 7 mm., ♂ 5-6 mm.

♀. Eyes strongly converging towards the base of the antennæ, thence diverging again towards the clypeus; separated at the base of the antennæ by a distance about equal to the length of the scape. Clypeus very broadly truncate at the apex, more than twice as broad at the apex as long, very

strongly narrowed to the base, minutely punctured. Second joint of the flagellum slightly longer than the third; the first stout and globular, more than half as long as the second. Posterior ocelli very far apart, at least three times as far from each other as from the eyes, separated from the eyes by a distance about equal to the diameter of one ocellus; the facets of the eyes very large in front, smaller on the sides. Head and thorax subopaque, microscopically punctured; median segment smooth and shining, the basal area well defined, the posterior slope divided by a longitudinal sulcus. Abdomen subopaque, minutely punctured; second ventral segment shining, with a few large and scattered punctures; pygidial area closely clothed with stiff fulvous setæ. Third abscissa of the radius about half as long again as the second; first recurrent nervure received by the first cubital cell at a distance from the apex equal to about half the length of the second abscissa of the radius; second recurrent nervure received just before the apex of the second cubital cell, strongly bent inwards towards the cubitus. Hind tibiæ feebly serrate.

♂. The eyes are distinctly further apart at the base of the antennæ than in the female.

Hab. Kuranda, N. Queensland (*F. P. Dodd*).

This is nearly allied to *lucidulus*, Turn., from the same locality, but is a smaller species, with many more yellow markings and differently coloured legs. The second abscissa of the radius is shorter in *lucidulus* and the first recurrent nervure is received nearer to the apex of the first cubital cell. The punctures are more minute than in *duboulayi*, Turn., which is also very closely allied.

Subfamily *LARRINÆ*.

Key to the Australian Species of Notogonia.

♀ ♀.

1. Eyes separated on the vertex by a distance fully equal to the length of the scape; tarsal ungues not unusually long *N. australis*, Sauss.
- Eyes separated on the vertex by a distance not exceeding three-quarters of the length of the scape, usually much less; tarsal ungues unusually long 2.
2. Dorsal surface of the median segment coarsely reticulate *N. retiaria*, Turn.

- Sculpture of the dorsal surface of the median segment almost obsolete, sometimes with indistinct transverse striae. 3.
3. Median segment with a longitudinal sulcus on the dorsal surface; the lateral and posterior margins not sharply defined *N. abbreviata*, Turn.
- Dorsal surface of the median segment without a sulcus, the margins sharply defined 4.
4. Comb of the fore tarsi long, the spines strongly spatulate *N. spathulifera*, Turn.
- Comb of the fore tarsi short 5.
5. The whole mesonotum densely clothed with golden pubescence *N. chrysonota*, Sm.
- Pubescence of the mesonotum sparse, except on the sides, not golden 6.
6. Wings with a broad fuscous fascia across the middle, the apex also fuscous, leaving a hyaline lunule; the fuscous band sometimes extending to the base. *N. regina*, Turn.
- Wings fusco-hyaline or hyaline 7.
7. Fourth abscissa of the radius distinctly shorter than the second and third combined; apical truncation of the radial cell broad, oblique or straight. 8.
- Fourth abscissa of the radius at least as long as the second and third combined; apical truncation of the radial cell narrower, never oblique 9.
8. Truncation of the radial cell oblique; distance between the recurrent nervures on the cubitus almost equal to the second abscissa of the radius *N. obliquetruncata*, Turn.
- Truncation of the radial cell straight; recurrent nervures almost meeting on the cubitus *N. recondita*, Turn.
9. Second joint of the flagellum distinctly shorter than the third; apical joint of the tarsi ferruginous *N. agitata*, Turn.
- Second joint of the flagellum at least equal to the third; apical joint of the tarsi never ferruginous above 10.
10. The depression on the middle of the anterior margin of the mesonotum very broad, extending posteriorly beyond the middle of the segment *N. serena*, Turn.
- The depression on the middle of the anterior margin of the mesonotum not very broad; not nearly reaching the middle of the segment 11.
11. Distance between the eyes on the vertex not more than half as great again as the length of the first joint of the flagellum; median segment no longer

- than its basal breadth; wings fusco-hyaline *N. commixta*, Turn.
 Distance between the eyes on the vertex equal to twice the length of the second joint of the flagellum; median segment longer than its basal breadth; wings subhyaline *N. basilissa*, Turn.

1. *Notogonia australis*, Sauss.

- Tachytes australis*, Sauss. Mem. soc. phys. & hist. nat. Genève, xiv. p. 19 (1854). ♀ (nec 1867).
Larrada australis, Sauss. Mélang. Hymén. ii. p. 69 (1854).
Larra australis, Turn. Proc. Zool. Soc. London, p. 474 (1908); Turn. Ann. & Mag. Nat. Hist. (8) xv. p. 554 (1915).
Notogonia australis, Turn. Ann. & Mag. Nat. Hist. (8) xvii. p. 251 (1916).

This interesting species approaches *Larra* in the short tarsal ungues and sparse pubescence of the pygidial area, also in the characters of the head; but otherwise it has the characters of *Notogonia*, and is best placed in that genus.

Hab. Eaglehawk Neck, Tasmania (*Turner*); Adelaide, S.A.; Yallingup, W.A. (*Turner*).

2. *Notogonia abbreviata*, Turn.

- Notogonia abbreviata*, Turn. Proc. Zool. Soc. London, p. 481 (1908).

Easily distinguished by the median segment, which is not margined laterally or apically, and has a median sulcus on the dorsal surface. The incision of the mandibles is much less distinct than in typical *Notogonia*, approaching *Liris*.

Hab. Cairns and Mackay, Q. (*Turner*).

3. *Notogonia retiaria*, Turn.

- Notogonia retiaria*, Turn. Proc. Zool. Soc. London, p. 479 (1908). ♀.

The median segment of this little species has the dorsal surface coarsely reticulate; the third cubital cell is also much less produced on the cubitus than in most species of the genus. Allied to the Indian *N. reticulata*, Cam.

Hab. Kalamunda, W.A. (*Turner*), April; Kuranda, Q. (*Turner*), June.

4. *Notogonia regina*, Turn.

Notogonia regina, Turn. Proc. Zool. Soc. London, p. 475 (1908). ♀.

Easily distinguished by the very broad fuscous fascia and apical margin of the fore wing, a hyaline lunule being left occupying the apical half of the radial cell, the third cubital cell, and a large part of the area beyond the cells. The female has orange antennæ. In a specimen from Cape York the whole fore wing except the lunule is fuscous.

Hab. Mackay, Q. (*Turner*); Kuranda, Q. (*Turner*); Cape York, Q. (*Turner*).

5. *Notogonia spathulifera*, sp. n.

♀. Nigra; argenteo-pubescent; alis fusco-hyalinis; tarsis anticis spinis longis spatulatis instructis.

Long. 16 mm.

♀. Clypeus closely microscopically punctured, with a few large punctures near the apex, slightly convex, clothed rather sparsely with very pale golden pubescence, which extends on the front as far as the anterior ocellus. Second and third joints of the flagellum subequal; the eyes separated on the vertex by a distance exceeding the length of the second joint of the flagellum. Mesonotum broadly depressed in the middle of the anterior margin, the depression extending beyond the middle of the segment, which is closely microscopically punctured and clothed on the sides with very pale golden pubescence. Median segment a little longer than its basal breadth, the sides somewhat depressed, but distinctly margined, the depressed portion rather strongly transversely striated, the striæ not extending on to the flat dorsal surface, but extending over the lateral carinæ on to the sides of the segment, where they become much more delicate and indistinct; the depressed lateral portions of the dorsal area clothed with silver pubescence; the posterior truncation abrupt, the surface transversely striated on the sides, and with a deep median sulcus. The four basal dorsal segments of the abdomen with broad apical fasciæ of silver pubescence; pygidial area closely and rather strongly punctured, clothed with dull pubescence which in some lights shows silver, the lateral margins well defined, strongly convergent towards the apex, which is very narrowly truncate. Third abscissa of the radius twice as long as the second, the fourth considerably longer than the second and third combined; the distance

between the recurrent nervures on the cubitus equal to the second abscissa of the radius.

Hab. Port Darwin, N.T. (*G. F. Hill*) ; Bathurst Island, N.T. (*Dodd*).

This closely resembles *N. serena*, Turn., superficially, but may be easily distinguished by the long spatulate spines of the fore tarsi and by the much narrower pygidial area.

6. *Notogonia chrysonota*, Sm.

Larrada chrysonota, Sm. Trans. Ent. Soc. London, p. 304 (1869). ♀.

Larrada crassipes, Sm. Ann. & Mag. Nat. Hist. (4) xii. p. 294 (1873).

Notogonia chrysonota, Turn. Proc. Zool. Soc. London, p. 475 (1908).

Hab. Champion Bay, W.A. (*Du Boulay*) ; Adelaide, S.A.

7. *Notogonia serena*, Turn.

Notogonia serena, Turn. Proc. Zool. Soc. London, p. 478 (1908). ♀.

Nearly related to *spathulifera*, but differs in the short spines of the fore tarsus and in the much broader pygidial area. This is one of the commonest species of the genus in North Queensland.

Hab. Mackay and Cairns, Q.

8. *Notogonia obliquetruncata*, Turn.

Notogonia obliquetruncata, Turn. Proc. Zool. Soc. London, p. 479 (1908). ♀.

The truncation of the radial cell is oblique and broad, making the cell shorter than in the other species. The depression on the median segment does not reach the middle.

Hab. Port Darwin (*Turner*) ; Yallingup, W.A. (*Turner*).

9. *Notogonia commixta*, Turn.

Notogonia commixta, Turn. Proc. Zool. Soc. London, p. 480 (1908). ♀.

The abdominal fasciæ are more obscure than in the most nearly allied species. It is a fairly common species at Kuranda.

Hab. Kuranda, Q. (*Turner*), February to July.

10. *Notogonia basilissa*, Turn.

Notogonia basilissa, Turn. Proc. Zool. Soc. London, p. 476 (1908). ♀.

The type has the apical joints of the antennæ orange, but I think that this is an aberration; other specimens apparently of the same species have the antennæ wholly black.

Hab. Mackay and Cairns, Q. (*Turner*).

11. *Notogonia agitata*, Turn.

Notogonia agitata, Turn. Proc. Zool. Soc. London, p. 477 (1908). ♀.

This has the second joint of the flagellum distinctly shorter than the third; it is a smaller species than the two last, but is very closely allied.

Hab. Mackay, Q. (*Turner*).

12. *Notogonia recondita*, sp. n.

♀. Nigra, albido-pubescent; tarsi articulo apicali ferrugineo; segmentis dorsalibus 1-4 fascia lata apicali sordide albo-pubescente; alis subhyalinis, venis ferrugineis; tegulis testaceis.

♂. Femine similis; tarsi articulo apicali fusco.

Long., ♀ 8-9 mm., ♂ 6.5 mm.

♀. Clypeus and front closely clothed with silver pubescence; the clypeus minutely punctured, subcarinate longitudinally in the middle; the apical margin transverse, smooth and shining. Second and third joints of the flagellum subequal; the eyes separated on the vertex by a distance about equal to the length of the second joint of the flagellum. Pronotum scarcely depressed below the mesonotum, higher in the middle than at the sides, obliquely sloped anteriorly. Median depression of the anterior margin of the mesonotum almost obsolete; the apical angles clothed with whitish pubescence. Median segment longer than the basal breadth; the dorsal surface finely granulate, with an almost obsolete median carina, and a few short transverse striæ near the apical angles; abruptly truncate posteriorly, the surface of the truncation finely transversely striate, with a deep median sulcus. Pygidial area long and narrow, very narrowly truncate at the apex, shining, with large scattered punctures, almost entirely without pubescence. Comb of the fore tarsi short. Radial cell broadly truncate at the apex; the third abscissa of the radius at least half as long again as the

second, the two combined much longer than the fourth ; the recurrent nervures almost meeting on the cubitus.

Hab. Mackay, Q. (*Turner*), November to March ; Kuranda, Q. (*Turner*), May.

This belongs to the group of small species with a broadly truncate radial cell and a short fourth abscissa of the radius, to which *N. obliquetruncata* also belongs. From that species it is separated by the straight apical margin of the radial cell, by the shorter second abscissa of the cubitus, by the greater approximation of the recurrent nervures, and by the much narrower pygidial area. In *obliquetruncata* the sides of the pygidial area diverge strongly towards the base, but only slightly in the present species ; the surface of the area is bare throughout in the present species, only on the basal half in *obliquetruncata*. This is the Australian form of the wide-ranging *N. pompiliformis*, Costa.

Lyroda queenslandensis, sp. n.

♂. Niger ; scapo subtus tegulisque testaceis ; mandibulis basi, abdomine segmentis primo secundoque, tibiis, tarsis anticis, tarsisque intermediis et posticis hic illic infuscatis, ferrugineis ; alis hyalinis, venis ferrugineis.

Long. 6 mm.

♂. Clypeus short and broad, minutely punctured and clothed with silver pubescence, with a distinctly longitudinal carina, the apical margin feebly excised in the middle. Head opaque, not visibly punctured, a very delicate frontal sulcus reaching the anterior ocellus. Second joint of the flagellum equal to the third, twice as long as the first. Inner margins of the eyes parallel, the posterior ocelli as far from the eyes as from each other. Thorax opaque, minutely and closely punctured ; a transverse, crenulate, impressed line at the base of the scutellum, the latter less opaque than the mesonotum. Median segment a little shorter than the basal breadth, slightly narrowed to the apex, very finely granulate, with a distinct median carina ; the sides of the segment very closely and minutely striato-punctate ; the surface of the posterior truncation rather coarsely transversely striated, with a shallow median sulcus. Abdomen shining, microscopically punctured ; dorsal segments 1-4 with an apical band of very short and sparse white pubescence. Third abscissa of the radius distinctly longer than the second, the third cubital cell less than twice as long on the cubitus as on the radius ; first recurrent nervure interstitial with the first transverse cubital

nervure, second received close to the middle of the second cubital cell.

Hab. Bundaberg, Q. (*Perkins*).

This is near *formosa*, Sm., an Indo-Malayan species, but differs in the colour of the legs and scape. It differs widely from the other Australian species *L. michaelsoni*, Schulz, both in colour and the sculpture of the median segment, also in the position of the recurrent nervures and the shape of the third cubital cell.

Subfamily NITELINÆ.

Key to the Australian Genera.

- | | |
|--|------------------------------|
| 1. Radial cell appendiculate; first transverse cubital nervure oblique, almost interstitial with the recurrent nervure; pronotum short, the dorsal surface transverse | <i>Nitela</i> , Latr. |
| Radial cell without an appendix; first transverse cubital nervure joining the radius at right angles, the recurrent nervure received far before the end of the cubital cell; pronotum long, produced and narrowed anteriorly | <i>Auchenophorus</i> , Turn. |

Key to the Australian Species of *Nitela*.

- | | |
|---|-----------------------------------|
| 1. Legs entirely ferruginous | 2. |
| Legs almost entirely black | <i>N. australiensis</i> , Schulz. |
| 2. Mesonotum coarsely transversely striate-reticulate | <i>N. reticulata</i> , Turn. |
| Mesonotum opaque, the sculpture indistinct and fine | <i>N. kurandæ</i> , Turn. |

1. *Nitela australiensis*, Schulz.

Nitela australiensis, Schulz, Fauna Südwest Australiens, i. xiii. p. 483 (1908).

Nitela nigricans, Turn. Trans. Ent. Soc. London, p. 428 (1910).

I do not think, after an examination of specimens from different localities, that these can be separated. The species has a very wide range in Australia, and may be found on dead *Eucalyptus* trees which have been attacked by small beetles, in the holes of which the *Nitela* probably forms its nest. Tasmanian specimens differ slightly, having the posterior ocelli further from the eyes than in the typical form, but they are not typical *nigricans*.

Hab. Yallingup, W.A. (*Turner*); Bundaberg, Q. (*Perkins*); Kuranda, Q. (*Turner*); Eaglehawk Neck, Tasmania (*Turner*).

2. *Nitela kurandæ*, Turn.

Nitela kurandæ, Turn. Proc. Zool. Soc. London, p. 508 (1908). ♀.

Hab. Kuranda, Q. (*Turner*), January to June; Bundaberg, Q. (*Perkins*); Caloundra, Q. (*Hacker*), September.

3. *Nitela reticulata*, Turn.

Nitela reticulata, Turn. Proc. Zool. Soc. London, p. 508 (1908). ♀.

This is easily distinguished from other Australian species by the coarse sculpture of the mesonotum. It appears to be much more uncommon than the others, as I have only seen the type.

Hab. Mackay, Q. (*Turner*), May.

Key to the Species of Auchenophorus.

1. Thorax, median segment, and abdomen entirely blue-green or blackish 2.
 Prothorax, mesonotum, and three basal abdominal segments ferruginous red, the remainder of the thorax and abdomen and the median segment blue *A. coruscans*, Turn.
2. Enclosed area of the median segment triangular; median segment and abdomen blue-green; radial cell on the costa scarcely longer than the stigma, receiving the transverse cubital nervure close to the middle.. *A. æneus*, Turn.
 Enclosed area of the median segment broadly rounded at the apex; median segment and abdomen, except the ferruginous apical segment, blackish; radial cell on the costa much longer than the stigma, receiving the transverse cubital nervure far beyond the middle *A. fulvicornis*, Turn.

1. *Auchenophorus coruscans*, Turn.

Auchenophorus coruscans, Turn. Ann. & Mag. Nat. Hist. (7) xix. p. 271 (1907). ♀.

This beautiful species is the type of the genus, and is easily distinguished by the colouring. The pronotum is somewhat longer and much more convex than in the other species; the

neuration is similar to that of *æneus*, but the radial cell is a little longer.

Hab. Mackay, Q. (*Turner*), October and November.

2. *Auchenophorus æneus*, Turn.

Auchenophorus æneus, Turn. Ann. & Mag. Nat. Hist. (7) xix. p. 271 (1907), ♀.

Hab. Mackay, Q. (*Turner*), February; Kuranda, Q. (*Turner*), January.

3. *Auchenophorus fulvicornis*, Turn.

Auchenophorus fulvicornis, Turn. Ann. & Mag. Nat. Hist. (7) xix. p. 272 (1907), ♂.

The female is much larger than the male, measuring 10 mm. in length, and is of more robust build than the other species. The enclosed area of the median segment is very coarsely longitudinally striated. The colouring is more obscure in the female than in the male. When the wings are closed this species closely resembles *Ephutomorpha impressiventris*, André, and other similarly coloured Mutillidæ, with which it is found running on the ground.

Hab. Kuranda, Q. (*Turner*), January.

XXXII.—*Rhynchotal* Notes.—LXI. By W. L. DISTANT.

HOMOPTERA.

Fam. Membracidæ (continued from p. 44).

Telingana recurvata, sp. n.

Head and pronotum black; a marginal frontal fascia on each side of pronotum beneath the bases of the lateral processes, suffusions to face, narrow basal margins of pronotum, and the scutellum greyishly tomentose; body beneath and legs black, posterior tibiæ (excluding apex) ochraceous, abdomen above with the segmental margins narrowly testaceous, beneath more or less greyishly tomentose; membrane pale æneous, the venation and narrow apical margin fuscous-brown, basal and costal areas black; pronotum coarsely

punctate and rugulose, the lateral processes outwardly and a little upwardly directed, strongly and regularly recurved, apices acute, above distinctly longitudinally carinate, posterior process slender, strongly tricarinate, in length reaching abdominal apex; scutellum distinctly longer than broad.

Long., excl. tegm., 8 mm.; breadth lat. pronot. process. 6 mm.

Hab. Borneo, Sarawak (*A. R. Wallace*).

Allied to *T. subsimilis*, Walk., but differing by the strongly recurved lateral pronotal processes, &c.

The *Centrotus subsimilis*, Walk. (Journ. Linn. Soc. Lond., Zool. i. p. 163, 1857), is founded on a damaged specimen in which the scutellum is mutilated.

Telingana? varipes.

Centrotus varipes, Walk. Journ. Linn. Soc. Lond., Zool. i. p. 164 (1857).

Hab. Borneo.

Walker's type is a mutilated specimen, and in his description of the thorax—"cornu postico brevi"—one must read "posterior pronotal process mutilated." The scutellum is also badly damaged.

Leptocentrus albonotata, sp. n.

Head, pronotum, body beneath, and legs black; basal margin of scutellum, lateral margins of face, and lateral spots to sternum greyish white; tegmina subhyaline, palely æneous, venation brownish, margins narrowly piceous or black, base black, immediately followed by a large greyish-white spot; pronotum thickly punctate, the lateral processes moderately short, straightly directed outwardly, gradually narrowing to apices which are acute, centrally longitudinally carinate, posterior process slender, tricarinate, well separated from the scutellum, almost obliquely straight, very slightly sinuate, its apex acute and slightly passing the posterior angle of inner tegminal margin; scutellum about as long as broad; eyes testaceous.

Long., incl. tegm., $6\frac{1}{2}$ mm.; exp. lat. pronot. process. $3\frac{1}{2}$ mm.

Hab. Nilgiris; Hillgrove, 400-600 feet, on coffee (Pusa Coll.).

Leptocentrus abdullah, sp. n.

Head, pronotum, and scutellum fuscous brown, distinctly pilose; legs castaneous; tegmina pale æneous, extreme base and costal area continued to apex, fuscous brown; pronotum coarsely punctate, the lateral processes very long, upwardly and outwardly directed, somewhat broadly compressed, above strongly longitudinally carinate, apices subtruncate, their anterior angles rounded, the posterior angles subacute, posterior process slender, tricarinate, elevated above scutellum, apical area depressed and about reaching abdominal apex; scutellum about as broad as long.

Long., incl. tegm., 8 mm.; exp. lat. pronot. process. 6 mm.

Hab. Siamese Malay States; Bultit Besar (*Annandale & Robinson*).

This species is very distinct by the long and suberect lateral pronotal processes.

ARIMANES, gen. nov.

Face stout and broad (imperfectly seen in unique carded type); pronotum long and narrow, not upwardly directed, narrower at apex than at base, strongly centrally carinate, the anterior lateral processes long, directed forwardly, scarcely outwardly, a little upwardly, their apices clavate and truncate, distinctly tricarinate, and between the carinations distinctly broadly sulcate, the upper carination extending about halfway over disk of pronotum, posterior process gradually narrowing from base to apex, moderately convexly curved and reaching tegminal apices, tricarinate; tegmina a little more than twice as long as broad, the costal and subcostal areas granulate, apical areas four.

This genus is allied to *Ceraon* and *Lubra*.

Arimanes doryensis, sp. n.

Head and pronotum piceous black, finely and somewhat obscurely sprinkled with minute whitish spots, the anterior lateral and posterior pronotal processes and body more piceous brown, a whitish tomentose fascia from outer base of each lateral process to sternum, where it is continued on each lateral margin; legs ochraceous; tegmina pale bronzy brown with a few obscure whitish tomentose spots; pronotum (including the anterior and posterior processes)

thickly punctate; other structural characters as in generic diagnosis.

Long., incl. tegm. and ant. pronot. process., 9 mm.

Hab. New Guinea; Dory (*A. R. Wallace*).

Centrotypus bowringi, sp. n.

Head, pronotum, and body beneath black; legs piceous; abdomen beneath and sternum thickly, longly, ochraceously pilose; tegmina shining castaneous, the costal area piceous; pronotum coarsely punctate, centrally strongly medially carinate, the lateral processes moderately broad, upwardly recurved, their upper surfaces distinctly longitudinally carinate, their apices broadly subacute, seen from the front more straightly oblique and apically acute, posterior process strongly tricarinate, its apex reaching the posterior angle of inner tegminal margin.

Long., incl. tegm., 7 mm.; exp. lat. pronot. process. 5 mm.

Hab. Penang (*J. C. Bowring*).

Allied to *C. shelfordi*, Dist., from Borneo, but differing in the shape and structure to the lateral pronotal processes, which are more slender and apically subacute than in that species.

Polonius, gen. nov.

General shape and form of the Australasian genus *Sertorius*, but with the posterior pronotal process not prominently thickened at its base, and only about reaching the posterior angle of the inner tegminal margin; apical areas to the tegmina longer and their veins more or less turned inwardly as in *Pogon*.

Polonius biseratensis, sp. n.

Head and pronotum black, finely shortly pilose, the face and front of pronotum longly, thickly, ochraceously pilose; legs castaneous, palely pilose; scutellum with an apical spot; tegmina castaneous, base and costal area black or piceous; pronotum finely punctate, centrally longitudinally carinate, the lateral processes very short and recurved, their apices acute, posterior process strongly tricarinate, moderately slender, its base very slightly separated from scutellum, its apex acute and about reaching the posterior angle of the inner tegminal margin; legs longly pilose.

Long., incl. tegm., $7\frac{1}{2}$ mm.; exp. tegm. 4 mm.

Hab. Siamese Malay States; Biserat (*Annandale & Robinson*).

Centrotus talumensis, sp. n.

Pronotum piceous, the disk sparingly blackly tuberculate, the lateral angles short, robust, thickly coarsely blackly tuberculate, their apices roundly truncate, very shortly and obsoletely acute, centrally transversely ridged, the disk with a black central carination continued on the posterior process, which is tricarinate and thickly somewhat finely punctate; scutellum with a dull ochraceous spot on each side of base, lateral areas of sternum also more or less dull ochraceous; face black, finely punctate; abdomen beneath greyishly pilose, the segmental margins dull ochraceous; legs castaneous brown; tegmina dark castaneous brown, basal and costal areas coarsely punctate.

Long. 8 mm.; exp. lat. pronot. process. 4 mm.

Hab. Siamese Malay States; Talum (*Annandale & Robinson*).

Allied to *C. matangensis*, Dist., a Bornean species, but with the lateral pronotal angles shorter and their apices, especially when viewed from the front, broader and truncate.

Otinotoides subflavipes.

Centrotus subflavipes, Walk. Journ. Linn. Soc. Lond., Zool. vol. x. p. 189 (1868).

Hab. New Guinea.

The type of this species is a mutilated specimen, the lateral pronotal process being almost absent and the posterior process being broken off before apex.

The species is allied to *O. pallipes*, Walk.

Otinotoides contractus.

Centrotus contractus, Walk. Journ. Linn. Soc. Lond., Zool. x. p. 188 (1868).

Hab. Aru.

GENUS LOBOCENTRUS.

Lobocentrus, Stål, Öfv. Vet.-Ak. Förh. 1870, p. 727.

Dograna, Dist. Faun. Brit. Ind., Rhynch. iv. p. 24 (1907).

Lobocentrus zonatus.

Lobocentrus zonatus, Stål, Öfvy. Vet.-Ak. Förh. 1870, p. 728.

Campylocentrus fulco, Buckt. Mon. Membrac. p. 243, pl. lvi. figs. 2, 2 a (1903).

Hab. Philippines.

Lobocentrus suffultus.

Dograna suffulta, Dist. Faun. Brit. Ind., Rhynch. iv. p. 24 (1907).

Hab. Bombay.

Eufairmairia densus.

Centrotus densus, Walk. Journ. Linn. Soc. Lond., Zool. i. p. 163 (1857).

Hab. Borneo.

Tricentrus acer.

Centrotus acer, Walk. List Hom., Suppl. p. 163 (1858).

Hab. Malacca.

Centrotus ferrugineus, Walk. Journ. Linn. Soc. Lond., Zool. x. p. 187 (1868).

Hab. New Guinea.

This is another mutilated unique specimen described by Walker, who accurately writes:—"The hind horn of the specimen here described is broken." In the absence of a perfect specimen, generic identification is impossible. It may belong to or come near the genus *Tricentrus*.

Otinotus oneratus.

Centrotus oneratus, Walk. Ins. Saund., Hom. p. 78 (1858).

Otinotus oneratus, Dist. Faun. Brit. Ind., Rhynch. vi. p. 160 (1916).

? *Centrotus invarius*, Walk. List Hom. ii. p. 621 (1851).

The unique type of Walker's *Centrotus invarius* is a mutilated specimen in which the apical area of the posterior pronotal process is missing. In all other respects the species appertains to *O. oneratus*, and, if accepted, would take priority in publication. I prefer, however, to leave *C. invarius* as a doubtful and mutilated type, the locality of which was uncertain and given by Walker as "China(?)."

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Nilautama tricornis.

Nilautama tricornis, Melich. Notes Leyd. Mus. xxxvi. p. 114, pl. iii. fig. 8 (1914).

Hab. Java (Jacobson). Siamese Malay States; Patani (Annandale & Robinson).

Nilautama? cicadiformis.

Centrotus cicadiformis, Walk. Journ. Linn. Soc. Lond., Zool. i. p. 164 (1857).

Hab. Borneo.

In describing this terribly mutilated specimen Walker writes:—"Lateral horns of the thorax almost obsolete; no hind horn." The lateral pronotal processes are clearly broken off near their bases, and are not, therefore, "obsolete"; the posterior process has clearly been broken off at its base by the action of the inserted entomological pin. It has the appearance of a *Nilautama*, but the venation of the tegmina is a little more reticulate near the apical areas.

Terentius rolandi.

Terentius rolandi, Dist. Ann. & Mag. Nat. Hist. (8) xvi. p. 492 (1915).

I described this species from a specimen collected by Mr. R. E. Turner in N. Queensland. Mr. Froggatt, of Sydney, has now sent me another specimen collected in New Guinea, Binituri River (Murray).

XXXIII.—*Some Notes on the Echimyinæ.*

By OLDFIELD THOMAS.

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IN a recent paper* Mr. Goldman has drawn attention to the advisability of separating what he terms "*Phyllomys*," the spiny rats with simple laminated upper molars, from "*Loncheres*," those with more complex teeth, and in the advantage of this separation I entirely agree. The names of the two genera are not, however, as Mr. Goldman has put them, but respectively *Nelomys* and *Echimys*, for reasons which have been already explained†.

* P. Biol. Soc. Wash. xxix. p. 125 (1916).

† Ann. & Mag. Nat. Hist. ser. 8, vol. xviii. p. 240.

The spineless species with complicated *Echimy*s-like teeth may be retained as a distinct genus, *Isothrix*, with type *I. bistrata*, and other species *villosa* (which perhaps = *bistrata*), *orinoci*, *picta*, and *pagura* [*I. pachyura*, Wagn., renamed later *I. crassicaudus*, was said to be probably the same as Lund's *Nelomys antricola*, which is a *Cercomys*]. At the same time, it may be observed that there appears to be no constant difference in skull or dentition between *Echimy*s and *Isothrix*, though the marked distinction in the characters of the coat justifies the retention of the genus *Isothrix*, with which *Lasiuromys* is synonymous.

Of the type-species of *Echimy*s, *E. chrysurus*, Zimm., of Guiana, the Museum possesses examples from the Upper Corentyn (Sir R. Schomburgk), R. Supinaam (F. V. McConnell), and Potaro Highlands (Dr. C. Bovallius), while a skin of the closely allied but smaller Amazonian species *E. paleaceus*, Licht., has been received from the Goeldi Museum, Para (locality, Peixe Boi), as also have two specimens of the "Toro" of the Lower Amazons, *Echimy*s *grandis*, Wagn. (Santarem and Faro).

The other Guiana species, which was described by me in 1888 as *Loncheres guianæ*, is unquestionably *E. armatus*, Geoff., whose determination has been long in doubt, but whose locality (Cayenne) and external characters, as shown in Lichtenstein's figure, absolutely agree with those of *L. guianæ*, with which *L. castaneus*, Allen, is also synonymous. The species ranges from Trinidad and the mainland opposite eastwards to Cayenne, and also occurs on the Lower Amazon (Para, Cametá) and in Northern Maranhão (Miritiba). It is exceedingly variable in coloration, as is shown by our considerable series from British Guiana, where it is very common.

Finally, the three closely related species *semivillosus*, *punctatus*, and *carrikeri* occur in Eastern Colombia and Venezuela, but material does not exist for their proper comparison with each other.

In *Nelomys* (syn. *Phyllomys*) the upper molars consist of four simple transverse laminæ, which persist without coalescing with each other at different ages, this continued separation being due to the equal depth of the three transverse valleys dividing the laminæ. In *Echimy*s and *Isothrix*, owing to the varying depth of the valleys, the laminæ coalesce and present a more complicated pattern, which varies at different ages.

Of *Nelomys blainvillei*, Jourdan, the genotype, the Museum possesses one of the original specimens collected on the Isla

de Deos, Bahia, by M. Blanchet, and sent by M. Pictet to the Zoological Society's Museum in 1838 (B.M. no. 55. 12. 24. 116). Unfortunately the skull is missing, one ramus of the lower jaw being alone preserved; but from this, as from the figures of the teeth published by Geoffroy and Wagner, there can be no doubt that this handsome species, of which no recent specimens have been recorded, has the laminated upper teeth above described. Whence it follows that the genus should be termed *Nelomys*, this name antedating *Phyllomys* by two years. All the species of the genus are spiny, for it now proves that the non-spiny species deserve generic separation from true *Nelomys*.

"*Loncheres*" *caniceps*, Günth., from Antioquia, is the first described of these latter, and, besides the type, the Museum contains an example from Bayone, North Ecuador, collected by Flemming and Miketta. Two other allied species, both from Panama, are *Loncheres labilis*, Bangs, and *Isothrix darlingi*, Goldman. All three have been placed in *Phyllomys* by Goldman.

But on examination of the teeth of the two specimens of *caniceps* above referred to, I have found that not only are the upper molars transversely laminated, as in *Nelomys*, but the lower molars are of similar structure, which is not the case in *Nelomys*, whose lower teeth, unlike the upper, are complicated, very much as in *Echimyis*, with the laminae variously forked and united. Excellent figures of two stages of the *Nelomys* molars were given by Hensel*, and from these the characters may be readily perceived.

But in *caniceps*, and presumably in *labilis* and *darlingi*, all the laminae of the lower teeth are as completely separated as those of the upper teeth, and though the middle one of each molar is slightly bowed and angularly convex forward in the centre, yet there is no complexity or junction between different laminae, as is the case in *Nelomys*.

On this account I have suggested† that a new genus, termed *Diplomys*, should be formed for *caniceps* and its relatives. Briefly stated, its diagnosis would be as follows:—

Lower molars simply and transversely laminated, duplicating the character of the upper ones.

Fur rather harsh, but not definitely spinous. Other characters as in *Nelomys*.

Genotype. *Diplomys caniceps* (*Loncheres caniceps*, Günth.).

Other species. *D. labilis* (Bangs), *D. darlingi* (Goldman).

Range. Panama, Colombia, and Ecuador.

* Abh. Ak. Berl. 1872, pl. i. figs. 11 & 12.

† Ann. & Mag. Nat. Hist. (8) xviii. p. 240.

It thus appears that the ranges of the genera of the present group are to a great extent separate, *Nelomys* being South Brazilian, *Echimy*s and *Isothrix* occurring in Amazonia and the countries to the northwards, while *Diplomys* is alone found in Colombia and Panama.

With regard to the species of *Nelomys*, much confusion and ignorance exists, largely owing to the fact that so many of the earlier species were described without their exact localities being known, and often without reference to their dental characters. For these reasons it is impossible to identify with any certainty, and I would propose altogether to set aside, the animals bearing the specific names of *didelphoides*, Desm., *obscurus*, Wagn., and *unicolor*, Rüpp., until such time as a competent examination of the type-specimens shows what the names represent. Possibly, however, all three are the form of the Rio Janeiro region, for which I now provisionally use Lund's name *brasiliensis*.

Wagner's *nigripinna*, of São Paulo, is as yet unrepresented in the Museum; but, thanks to the kindness of Dr. H. von Ihering, we have three specimens of the largest species, *thomasi*, of the Island of São Sebastião, originally described as a *Mesomys*. And of the smaller southern forms, *medius* and *dasythrix* we have a number of specimens, including the type of the former and a co-typical skull from Hensel's collection of the latter.

From the most northern point of the range of the genus, north-west of Bahia, we have a fine series of a species which appears to be new, and may be called

Nelomys lamarum, sp. n.

Size small, about as in *brasiliensis* and *dasythrix*. General colour paler than in any other species, the general tone above little darker than "ochraceous buff"; sides clearer and paler, becoming more drabby on the sides of the belly. Underside generally pure white to the roots of the hairs from chin to inguinal region, but the white is of very variable breadth, either extending nearly the full breadth of the belly, narrowed to a mere middle line, which is the most usual condition, or altogether interrupted over the ventral area. Head rather greyer than back; whiskers and the inconspicuous tufts over the ears brown. Spines of back about 18 mm. in length, grey, with a blackish subterminal band and a buffy tip; hairs between the spines similarly grey, with bright buffy or ochraceous ends. Hands and feet buffy whitish. Tail about as long as the trunk, its base hairy, the remainder thinly hairy, the hairs not hiding the scales, the terminal tuft little

developed; brown above, whitish below; scales about ten to the centimetre.

Skull about as in *N. dasythrix*, the palatal notch perhaps deeper and sharper. Relation of back of nasals to end of premaxillary processes very variable.

Dimensions in the flesh:—

Head and body 220 mm.; tail 212; hind foot 33; ear 14.

Skull: greatest length 51; condylo-incisive length 45; zygomatic breadth 24; nasals 15.2×5 ; interorbital breadth 11; palatilar length 19; upper tooth-series 11.2.

Hab. Lamarão, Bahia, about 70 miles N.W. of Bahia city. Alt. 300 mm.

Type. Adult female. B.M. no. 3.9.5.96. Original number 1414. Collected 24th May, 1903, by Alphonse Robert. Presented by Oldfield Thomas. Thirteen specimens.

This species is readily distinguishable from any other we have by its pale colour and less bushy tail. It had been provisionally determined as *didelphoides*, Desm., but there is really nothing to connect it with that species, which had no locality, is far smaller, and was stated to be of a brown colour, which no one would say of the present animal. Indeed, there is no evidence that *didelphoides* even belonged to the restricted genus *Nelomys*.

Of the original *Echimyus hispidus*, "Geoff.," apparently first validly published by Desmarest in 1817, I have, by the kindness of Dr. Anthony, been privileged to examine the typical skull, still preserved in the Paris Museum. This shows that *E. hispidus*, about which so much confusion has arisen from time to time, belongs to none of the genera to which it has been hitherto referred, but is a *Mesomys*, apparently quite similar to *M. ecaudatus*, Wagn. As a result, the early and suitable name *hispidus* will happily replace the unfortunate term *ecaudatus*, given to a specimen which had lost its tail. Some notes on the characters of this rare genus were published in 1905*.

DACTYLOMYS.

A comparison of our specimens of *Dactylomys dactylinus*, Geoff., and *D. peruanus*, Allen, indicate that they might very well represent distinct subgenera. *D. dactylinus* has its long tail practically naked (apart from the base), the few fine hairs on it not at all hiding the scales, which are large and conspicuous. Indeed, it is the most prominently naked tail in the family, almost rivalling that of *Uromys* in this respect.

* Ann. & Mag. Nat. Hist. (7) xv. p. 590.

On the other hand, *D. peruanus* has a very hairy tail, which is really quite bushy for the basal half, and well clothed to the more or less tufted end, the scales being only just perceptible between the hairs on the subterminal fifth. This difference gives the animals quite a different appearance, and no doubt indicates a difference in habits.

In the teeth, while the outer re-entrant angles in the upper molars of *D. dactylinus* are of equal extension throughout, running from one-half to three-fifths across each tooth, in *D. peruanus* their angles, similar to those of *dactylinus* in the premolar and m^1 , are in m^2 and m^3 of unequal extension, the posterior running across nearly to the inner edge of the tooth, while the anterior is as in the other teeth.

Under these circumstances I would suggest that *D. peruanus* should form the type of a new subgenus, which might be called *Lachnomys*.

The claws of *Lachnomys*, both before and behind, are absolutely as in true *Dactylomys*.

THRINACODUS.

This genus is very nearly allied to *Dactylomys*, but differs in the character of its claws, which are normal throughout, except that the second hind pair is modified into an oblique asymmetrical nail, as in many other members of the family. Its tail is intermediate in hairiness between that of true *Dactylomys* and of *Lachnomys*. The angles of its molars approach those of the latter form.

The specimens available come from three different regions—Merida, Bogota, and Antioquia, the last being the type-locality.

Those from Merida have distinctly larger skull and larger teeth, and might be distinguished specifically.

Thrinacodus edax, sp. n.

Colour and other external characters as in *T. albicauda*, but the tail completely white along the under surface, the terminal half above also white; line of demarcation fairly abrupt.

Skull larger than in *T. albicauda*. Molars broader and heavier. In an adult topotype of *albicauda* the breadth across the most distant points of the two premolars is 8.5 mm., and the breadth of each tooth, measured diagonally from the front of the two inner points to the second of the outer points, is 4.0 mm., while in *edax* these measurements are respectively 9.2 and 4.6 mm.; and the other teeth are all in proportion.

Dimensions of the type (measured on skin):—

Head and body 225 mm.; tail 345; hind foot 46.5.

Skull: greatest length 57; condylo-incisive length 51.4; zygomatic breadth 29.3; nasals 18.2×6 ; interorbital breadth 12.2; palatilar length 23; upper tooth-series 15.2.

Hab. Sierra de Merida. Alt. 2800 m.

Type. Adult male. B.M. no. 5. 7. 5. 7. Original number 17. Collected on 15th December, 1903, by S. Briceño. Three specimens.

On the other hand, the specimens from Bogota and Antioquia agree closely with each other in all important respects.

The last group on which I have any comment to make is that of the short-tailed spiny rats, which includes Azara's spiny rat, the first of the subfamily to be discovered, and nearly the last to have its technical name settled. For Fleming's selection of *E. chrysurus* as the type of *Echimy*s has dispossessed *spinosus* of the generic name by which it has been so long known, and it must now bear Goeldi's term *Euryzygomatomys*.

But further consideration makes me think that its Brazilian relative, "*Echimy*s" *laticeps*, differs so much from it as to justify the erection for it of a special genus, which might be diagnosed as follows:—

CLYOMYS, gen. nov.

Fore-claws fossorial, much longer than in *Euryzygomatomys*.

Bullæ hypertrophied, a great part of them visible external to the paroccipital processes when viewed from behind.

Molars proportionally small, the last upper soon losing the posterior transverse cleft, so that the tooth-surface is then circular, with one notch only on each side of it. In *Euryzygomatomys* the most worn teeth always show traces of a trilaminate structure.

Genotype. *Clyomys laticeps* (*Mesomys laticeps*, Winge*; *Echimy*s *laticeps*, Thos.).

Other distinctions between *spinosus* and *laticeps* are pointed out in my paper on the latter, which is the only member of the family with distinctly fossorial claws and hypertrophied bullæ.

* By the modern rules, the fact that Winge published the statement that "*Loncheres laticeps*, Lund=*Mesomys spinosus*, Desm.," made him the author of the specific name, even though he did not recognize the distinctness of the animal from *Mesomys spinosus*. His description and figures of the latter all refer to *Clyomys laticeps*.

Within *Euryzgomatomys* I now find it possible to distinguish from the true Paraguayan *spinosus* the form found in Santa Catherina as follows :—

Euryzgomatomys catellus, sp. n.

General colour and other external characters as in *E. spinosus*, except that on the under surface the white area is much reduced in extent. In *spinosus* the whole under surface from chin to inguinal region is white, and this colour extends nearly or quite over the whole breadth of the belly, where it grades, without very sharp line of demarcation, into the buffy or drab of the flanks. In *E. catellus*, on the other hand, the chin and throat are suffused with brownish, there is a marked brown patch in the middle of the chest, and the white of the belly is reduced to a comparatively narrow median area owing to the encroachment on it of the brownish or drabby flank-colour, from which its line of demarcation is somewhat abruptly defined.

The skull is, on the whole, similar to that of *E. spinosus*, except that the V of the palatal notch is less excessively narrow and pointed, and does not extend quite so far into the palate—at most to the posterior third of m^2 , and more often only to the hinder edge of that tooth.

Dimensions of the type (measured on the spirit-specimen before skinning) :—

Head and body 245 mm. ; tail 53 ; hind foot 35 ; ear 18.

Skull : greatest length 49 ; condylo-incisive length 46.2 ; zygomatic breadth 27.3 ; nasals 14.3×6.5 ; interorbital breadth 11 ; palatilar length 19.2 ; upper tooth-series 10.

Hab. Santa Catherina. Type from Joinville.

Type. Adult male. B.M. no. 9. 11. 19. 30. Collected by W. Ehrhardt. Four specimens.

I have provisionally used a binomial name for this animal ; but intermediate forms may prove to exist in the little-known country between its type-locality and that of *E. spinosus*, and it will then have to be regarded as a subspecies.

XXXIV.—On the Classification of the Cavies.

By OLDFIELD THOMAS.

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MR. WILFRED OSGOOD has recently published a suggested revision of the classification of the Cavies*, and has divided

* Field Museum Publ. Zool. x. p. 194 (1915).

them into two genera, one of these being subdivided into three subgenera. He recognizes the genus *Kerodon*, including *K. rupestris* only, as distinct from *Cavia*, mainly on account of its peculiar sternum and other skeletal characteristics, while within the large genus *Cavia* he only gives subgeneric importance to the molar characters usually used to distinguish *Cavia* s. s. from the other forms with teeth like those of *Kerodon*, which have generally been included in the latter genus.

Among these, again, he has discovered a character in the complete interruption of the maxillary in front of the lacrymals, to distinguish *Galea* (*musteloides*, *boliviensis*, *spizi*, &c.) from *Cavia* s. s. (*porcellus*, *aperea*, &c.) and "*Caviella*" (*australis*, *mænas*, &c.).

In naming some specimens recently received, I have had occasion to examine Mr. Osgood's classification, which is clearly a distinct advance in the matter, though I would venture to propose some amplification of it.

Mr. Osgood's sections, whether called genera or subgenera, are all clearly defined natural groups, easily distinguished from each other by definite characters, and I would, therefore, suggest that they should all be treated as genera.

In addition, I would erect a special genus for my *Cavia niata*, which is quite a specialized form, readily distinguishable from the other members of *Caviella*, in which Mr. Osgood includes it.

The following is a synopsis of the genera, the characters not being in any way detailed, as such of them as have not been published by Waterhouse and other earlier writers have been well described by Osgood:—

A. Cheek-teeth complicated, as indicated by

Waterhouse *, pl. vi. fig. 9 1. *Cavia*, Linn.

Genotype, *C. porcellus*, L. Other species: *C. aperea*, Erxl., *rufescens*, Lund, *cutleri*, Benn., *atahualpæ*, Osg.

B. Cheek-teeth comparatively simple (cf. Waterhouse, pl. vi. figs. 1-8).

a. Toes with claws. "Sternum broad and flat" (Osgood).

a². Skull shortened, bowed. Incisors unpigmented. Orbital branch of maxillary continuous as a narrow strip in front of lacrymals.

a³. Incisors nearly vertical, their angle to the line of the molars, measured as described in the footnote †, about 100°.

* Nat. Hist. Mamm. ii. (1848).

† When publishing the method of obtaining this important angle (J. Bombay N. H. Soc. xxiv. p. 408, footnote, 1916), I took it from the terminal part of the enamel-covered front of the tooth, believing that in

M^3 more complicated, with heel long and separated from the rest of the posterior lobe by a deep notch 2. *Caviella*, Osg.

Genotype, *C. australis*, Geoff. & D'Orb. Other species: *C. mænas*, Thos.

δ^3 . Incisors much thrown forward, their angle with the line of the tooth-row about 115° . M^3 less complicated, the heel a mere short triangular projection, without internal notch 3. *Monticavia*, g. n.

Genotype, *M. niata* (*Cavia niata*, Thos.). Other form: *M. niata pallidior*, Thos.

δ^2 . Skull not specially shortened. Incisors pigmented, directed backwards, their angle about 85° with the line of the tooth-row. Orbital branch of maxillary completely interrupted by lacrymal 4. *Galea*, Meyen.

Genotype, *G. musteloides*, Meyen. Other species: *G. boliviensis*, Waterh., *auceps*, Thos., *spixi*, Wagl., *flavidens*, Brandt, *wellsi*, Osg., *pallustris*, Thos.

δ . Toes with nails. Skeletal characters described by Osgood (*l. c.*) 5. *Kerodon*, F. Cuv.

Genotype, *K. rupestris* (*Cavia rupestris*, Wied).

this way a more exact measurement might be obtained. But this involves the anomaly that teeth which appear to the eye approximately vertical have a measured index of about 75° , instead of 90° , while teeth with a measured angle of 90° are in reality what one calls "thrown forward." The object of all such measurements being to give a more exact method of expression to eye-judgments, I would propose now to alter the measurement, to make it more in conformity with the general impression.

This may be done by adjusting one limb of the goniometer to the chord of the curve shown in side-view by the whole exposed part of the tooth, from the highest external corner where it issues from the bone to the tip of the tooth. The other limb is then adjusted parallel with the tooth-row, this being easily done by eye, and the resulting angle read off.

As explained before, specimens with properly developed incisors, neither pulled out nor pushed in, are necessary, and it is also essential that the examples should be without imperfections in the bone at the point where the incisors leave it.

The resultant angles are all, of course, considerably higher than before, and I now give the angles in the same animals measured in the revised way. *Rattus listeri* comes out at 52° instead of 26° – 28° , *R. rattus* 70° – 80° , *R. berdmorei* about 100° . *Rhizomys* 82° – 87° , *Nyctocleptes* 97° or 98° , *Bathyergus* about 105° , *Cannomys* 112° – 115° ; while in the most extreme form of all, *Heliophobius*, the angle is about 130° . A Canadian beaver stands at 90° , a *Cynomys* at 95° , and an *Ondatra* at 96° .

As before, a fairly large limit of error must be allowed; but this does not seem to be greater in the new way, which undoubtedly gives a truer idea of the angle at which the incisors are set.

Instead of a goniometer, a simple protractor may be used, and the angle judged by eye; but in that case the limits of error would undoubtedly be larger. Even then, however, there is a gain in exactness as compared with the old vague statements of "incisors thrown forward" or "directed backward," without any effort at measurement at all.

XXXV.—*Two new Argentine Rodents, with a new Subgenus of Ctenomys.* By OLDFIELD THOMAS.

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THANKS to the hospitality of the owners of the ranche, and especially to the kind assistance of Don Cecil Porteous, Mr. Robin Kemp has been enabled to make a collection of small mammals at La Maria Luisa Ranche, on the Pampas of Buenos Ayres Province. Among the specimens so obtained are a series of a Tuco-tuco, which appears to be distinct from any described.

It may be called

Ctenomys porteousi, sp. n.

Allied to *Ct. azaræ*, but larger, with much larger bullæ and less developed parietal ridges.

General colour above approximately "cinnamon-brown," lined with blackish, the median area of the back darkened, sometimes quite to black, but the dark area not sharply defined. Top of muzzle and crown also blackish. Under surface near "vinaceous buff" or rather more drabby, the bases of the hairs, as usual, dark slaty. Hands and feet buffy whitish. Tail dull whitish, drabby, or pale brown, the terminal crest darker, often blackish.

Skull, as compared with that of *Ct. azaræ*, decidedly larger (like sexes being compared), but of the same general shape. Crown smooth, the parietal ridges, which are particularly well marked in *azaræ*, almost imperceptible in the oldest specimens. Incisive fissure of medium size, close in front of the palatal foramina, and in the same general hollow with them. Foramen magnum unusually high, with either one or two projections downwards on its upper edge. Bullæ much larger than in *azaræ*, which, in turn, has them larger than in *talarum*. Incisors slightly less thrown forward than in *azaræ* (angle with tooth-row about 97° – 100° , as compared with 105° – 108°), their front surface rather darker in colour, approximately "xanthine orange."

Dimensions of adult male and female (the first the type) :—

Head and body 185, 150 mm.; tail 86, 79; hind foot 35, 32.

Skull: length in middle line 46·5, 42; condylo-incisive length 46·5, 41·5; diagonal length from gnathion to back of bulla 48·8, 44; zygomatic breadth 27·8, 25; nasals 16·5, 15;

interorbital breadth 9, 8·3; least breadth across brain-case 18·5, 18; greatest breadth on bullæ 26·8, 25·3; bullæ, length diagonally in horizontal plane 18, 17; breadth at right angles to last 9·5, 9. Upper molar series (alveoli) 10·9.

Hab. Bonifacio, S.W. Buenos Ayres Province, about 36° 40' S., 62° W. Other specimens from Papin, El Inca (thanks to the help of Mr. George Hughes), and La Zauja in the same region. Alt. 50 m.

Type. Adult male. Original number 2639. Collected by R. Kemp, 27th May, 1916. Sixteen specimens.

Just as *Ct. azaræ*, which occurs in the western half of the Buenos Ayres Pampas, from General Acha to San Rafael, differs from the Eastern *Ct. talarum* (La Plata to Bahía Blanca) by its slightly larger size and much larger bullæ, so it is in turn exceeded in both respects by the present form, which occurs between the two. The blackened area on the back also distinguishes this species, no such darkened area being present in *azaræ*.

I have named this distinct Tuco-tuco in honour of Don Cecil Porteous, but in doing so I may also recall the help Mr. Kemp has received from Col. J. J. Porteous in various matters connected with his trip.

The fine series obtained by Mr. Kemp indicates that the males average decidedly larger than the females, a point which it is not always easy to determine owing to the great difficulty in this genus of deciding as to the age of individual specimens.

The genus *Ctenomys*, as a whole, is remarkably uniform in superspecific characters, and I find it impossible to subdivide it in any way, with the one exception that *Ct. leucodon*, Waterh., of the Bolivian Plateau, differs so much by its practically unpigmented incisors and the extent to which they are thrown forward (angle about 118°, the majority of the species being about 100° or, at most, 110°) that it apparently deserves subgeneric distinction. I would suggest for the new subgenus the name of *Haptomys*.

Reithrodon cuniculoides pampanus, subsp. n.

General essential characters as in *cuniculoides* of the south, not as in the more northern *typicus*. Body-colour of the same greyish olivaceous as examples from the Valle del Lago Blanco which I assign to *hatcheri*, Allen, but fur rather shorter. Feet smaller, slenderer, and less heavily furred, though the terminal part of the sole is not so naked as in *typicus*. Tail well-furred, as in the southern form, but less

strongly contrasted dark and light, the dark line along its upper side narrower and with less black in it.

Skull with the posterior nares narrowed and closed in to a sharp angle, level with the front edge of the pits in the parapterygoid fossæ, just as in *cuniculoides* and *hatcheri*, not as in *typicus*. Colour of incisors darker than in *cuniculoides*.

Dimensions of the type (measured in flesh):—

Head and body 145 mm.; tail 85; hind foot 29; ear 23.

Skull: greatest length 35·5; condylo-incisive length 32·6; zygomatic breadth 19·8; nasals 15; palatilar length 16·8; palatal foramina 9; postforaminal palate 7; upper molar series 6·7.

Hab. Southern pampas of Buenos Ayres Province. Type from Peru, F.C.P., about 200 kilometres N.W. of Bahia Blanca.

Type. Young adult male. B.M. no. 13. 11. 1. 1. Original number 3. Collected 20th July, 1913, and presented by F. H. F. Parkes, Esq. Three specimens. Others obtained by A. W. Whyte and W. A. Smithers.

This seems to be the northern representative of the *R. cuniculoides* of Patagonia, differing from *R. typicus* of Uruguay and Corrientes by more essential characters than any that separate the southern forms from each other. On this account I should consider *hatcheri* also as a subspecies of *cuniculoides*, although I confess I have not for comparison modern topotypes of the latter. But, according to the describer of *R. hatcheri*, the differences are mainly in colour.

XXXVI.—On the *Tooth-change*, *Cranial Characters*, and *Classification of the Snow-Leopard or Ounce* (*Felis uncia*).

By R. I. Pocock, F.R.S., Superintendent of the Zoological Society's Gardens.

THIS paper is based mainly upon a series of skulls in the collection of the Zoological Society. Two of the series are those of the snow-leopard or ounce (*Felis uncia*), whose cranial characters have never been fully described, so far as I am aware. The animals themselves lived only a few months in captivity. Hence the features the skulls present may be regarded without hesitation as normal. Neither animal was mature, and since by chance these skulls show very clearly the successive steps in the tooth-change, an account of that process may be interesting. Of greater interest, however, are certain characteristics shown

by the occipital region, more particularly those connected with the tympanic bullæ, when compared with those parts in *F. leo*, *tigris*, *pardus*, and *onca*.

The Succession of the Teeth.

There is nothing noteworthy in the structure of the teeth of the deciduous set.

In the smaller of the two skulls, measuring 125 mm. in basal length, the tooth-change has just started. In the upper jaw the two inner pairs of deciduous incisors have been shed and replaced by those of the permanent set, which are fully erupted; but the deciduous outer incisors are still in place, with the tips of the corresponding teeth of the permanent set appearing through the bone just behind them.

The first deciduous premolar has been shed, pushed out by the crown of the permanent tooth, which, however, lies deep in its alveolus.

The canines and second and third premolars of the deciduous set are in place and fully functional; but the molar, lying some distance behind the last deciduous premolar, is through the bone, but not quite fully erupted.

In this stage, therefore, the four median incisors, the first premolars, and the molars of the permanent set are cut, while the outer incisors, the canines, and second and third premolars of the deciduous set are still in full use.

In the next stage, shown by the larger skull measuring 131 mm. in basal length, the outer deciduous incisors have been replaced by those of the permanent set, which are slightly higher than the rest of the series.

The deciduous canines are shed and the permanent canines are half-erupted.

The first permanent premolar and the molar are fully erupted, and the third permanent premolar (carnassial) has pushed out its small predecessor and is erupted nearly to the level of the deciduous second premolar, which is fully functional just in front of it, and is the only tooth of the deciduous set still retained.

On each side of the upper jaw, therefore, the permanent teeth become functional approximately in the following order:—(1) the two inner incisors; (2) the first premolar and the molar together; (3) the outer incisors; (4) the canine and the third premolar (carnassial) at the same time; (5) the second premolar. The deciduous teeth are shed in corresponding order, the last to fall being the second premolar (carnassial). Thus the carnassials of the deciduous and permanent sets are functional at the same time.

In the *mandible* of the smaller skull the deciduous incisors are shed, those of the permanent set being in place, although the outer teeth are shorter than the rest. The canines and premolars (pm_2 , pm_3) of the deciduous set are fully functional, but the alveolus of the molar (carnassial) is open, the posterior cusp projecting just above the bone.

In the second and older skull all the incisors are fully erupted, the deciduous canines are shed, and the permanent canines half up. The cheek-teeth on one side consist of the two deciduous premolars and the molar (carnassial), which is as high as the deciduous milk-premolar, but, on the other side, the first deciduous premolar (pm_2) has been pushed out by the tip of its successor, which is just level with the rim of the alveolus.

In each ramus of the mandible, therefore, the permanent teeth become functional approximately in the following order:—(1) the two inner incisors; (2) the outer incisor; (3) the molar (carnassial); (4) the canine; (5) the first premolar; (6) the second premolar.

The change in the upper and lower jaws closely coincides, allowance being made for the complete absence in the mandible of a tooth representing the first premolar of the maxilla and for the functional correspondence of the second and third premolars of the maxilla with the second premolar and molar of the mandible. Of the cheek-teeth, the first of the permanent set to erupt above and below are the molars, and the last to erupt are the teeth immediately preceding the permanent carnassials—that is to say, pm^3 of the maxilla and pm_4 of the mandible of the normal mammalian series.

The Cranial Characters of F. uncia.

The main sources of information known to me about the skull of *F. uncia* are the figure and description published by Gray*, and derived from a specimen with defective occiput and base, which was then, as it is now, the sole example available for examination in the collection of the British Museum.

In the Zoological Society's collection there are two perfect skulls of animals from Kashmir. The larger of the two, almost in the final stage of tooth-change, is only slightly smaller than the adult described by Gray, the total length in the latter being $6\frac{1}{2}$ inches and the zygomatic width $4\frac{7}{8}$ inches, whereas in mine the total length is $6\frac{1}{2}$ inches, the zygomatic width $4\frac{3}{8}$, and the basal length $5\frac{1}{4}$.

* P. Z. S. 1867, p. 262; Cat. Carn. Mamm. etc. p. 8 (1869).

The only obvious differences between the two skulls are the greater elevation of the forehead between the postorbital processes and the deeper depression at the base of the muzzle above in Gray's example. These differences are probably attributable to differences of age. However that may be, the closeness of the resemblances suggests that the specimen in the Zoological Society had attained practically its permanent form in the characters mentioned below, the more important of which are those cited as distinctive of *F. uncia* in comparison with *F. leo*, *tigris*, *pardus*, and *onca*, the species to which, as I have recently shown*, *F. uncia* is affiliated by the structure of the hyoid bone.

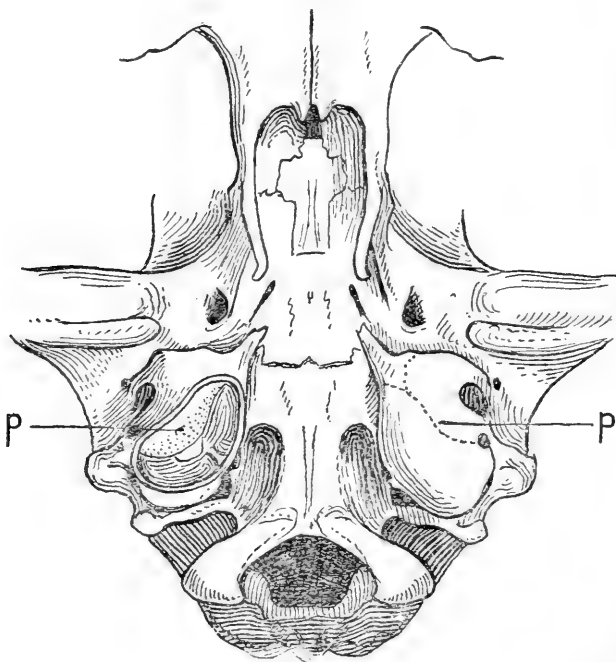
The principal cranial features of *F. leo*, *tigris*, *pardus*, and *onca* can be verified in any museum of repute. Those of *F. uncia* are, generally speaking, similar, but the skull is relatively broader, shorter, and more vaulted, being elevated between the postorbital processes and sloped and somewhat lynx-like in the muzzle, which is depressed posteriorly above. There is no evidence of the development of a strong sagittal crest or of a deep constriction behind or in front of the short blunt postorbital processes. The orbits are comparatively large in relation to the temporal fossæ and the posterior portions of the zygomata are not markedly salient. The upper end of the maxilla is long, acutely angled, and projects very noticeably farther back than the broad and short nasals. The straightness and inclination of the fronto-maxillary-nasal suture, the form of the premaxillæ, the plane of the anterior nares, the flatness of the cheek above the carnassial, the height of the lacrymal bone above the foramen, the large size of the anteorbital foramen as compared with the palatal foramen of the orbit, are practically as in the other species mentioned above. The mesopterygoid fossa is nearly parallel-sided, the hamulars only converge slightly posteriorly, the anterior angles are rounded, the anterior border transverse, with two small spines and a small median notch. The palate is moderately prolonged and narrow posteriorly, and the postero-lateral borders of the palate show an angular emargination passing in front of the line of the molar (fig. 1).

The most marked characters of the skull are found in the occipital region. The basioccipital is deeply excavated up against the bulla, the anterior end of the excavation deepening into a pit holding a thick muscular tendon (fig. 1). The foramen magnum is higher than wide, with a very thick

* Ann. & Mag. Nat. Hist. (8) vol. xviii. p. 221-229 (1916).

inferior border, and the condyles are everted, so that the distance between their inner edges exceeds the width of the foramen. The bullæ are separated by a very narrow valley from the vertical glenoid ridge of the squamosal (fig. 2 A, *v*), the groove on the bulla marking the line of the partition passes from the styloid to a point behind the basioccipital suture on the inner side and lies a long way below the

Fig. 1.



Base of skull of *Uncia uncia* with bulla of right side (left of figure) cut open to show the inner chamber and the partition (*p*) separating it from the outer or auditory chamber. On the left bulla *p* marks the groove showing the line of origin of the partition. Depressions on basioccipital also shown.

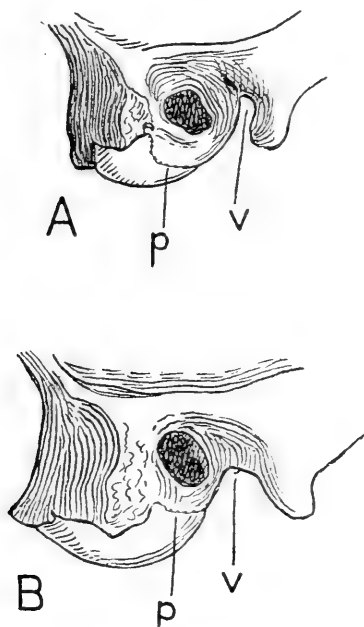
auditory meatus (figs. 1, 2, *p*). Thus the auditory chamber is comparatively very large and antero-internally passes in front of the extremity of the posterior chamber (fig. 4 C), the cavity of which is still further reduced by the convex bulging of the partition (fig. 1, *p*).

In the mandible the chin is nearly vertical in its anterior two-thirds and sharply curved backwards inferiorly.

In the sum total of its characters the skull of *F. uncia* differs considerably from the skulls of *F. leo*, *tigris*, *pardus*, and *onca*; but, as stated above, the most marked differences are found in the occipital region, which does not appear to have been previously described in *F. uncia*.

In *F. leo*, *tigris*, *pardus*, and *onca* the foramen magnum is wider than high, its inferior edge is comparatively thin, the width between the inner edges of the condyles is equal to

Fig. 2.

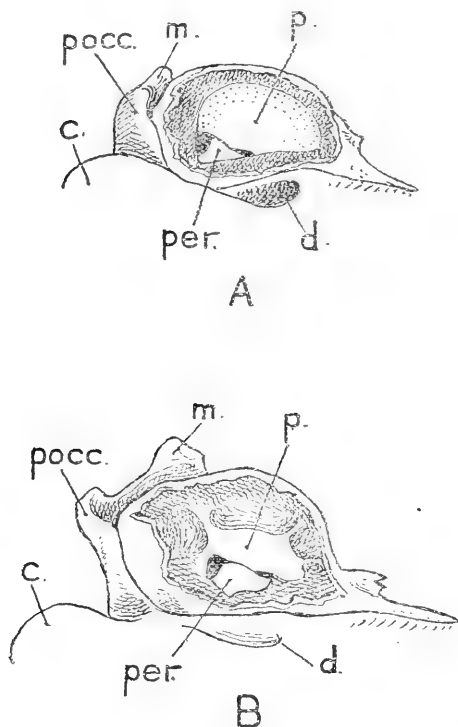


- A. Right tympanic bulla of *Uncia uncia* seen obliquely from behind, showing the narrow valley (*v*) between the bulla and the glenoid ridge of the squamosal and the line of origin of the partition (*p*).
 B. The same of *Panthera onca*.

the width of the foramen, there is no deep depression, deepening in front, up against the bullae on the basioccipital, and there is a comparatively wide valley between the bullae and the glenoid ridge of the squamosal (fig. 2 B, *v*). Finally, the partition of the bulla is low, rises tolerably close to the auditory meatus, the line of its origin running from a point just in front of the stylomastoid foramen to a point on the anterior face of the bulla (fig. 2 B, *p*); and when the bulla

is cut open the posterior chamber is seen to be much larger than the anterior or auditory chamber, and its auditory portion extends forwards along the inner part of the bulla approximately as far as, or farther than, the anterior part of the auditory chamber (fig. 4 A, B).

Fig. 3.

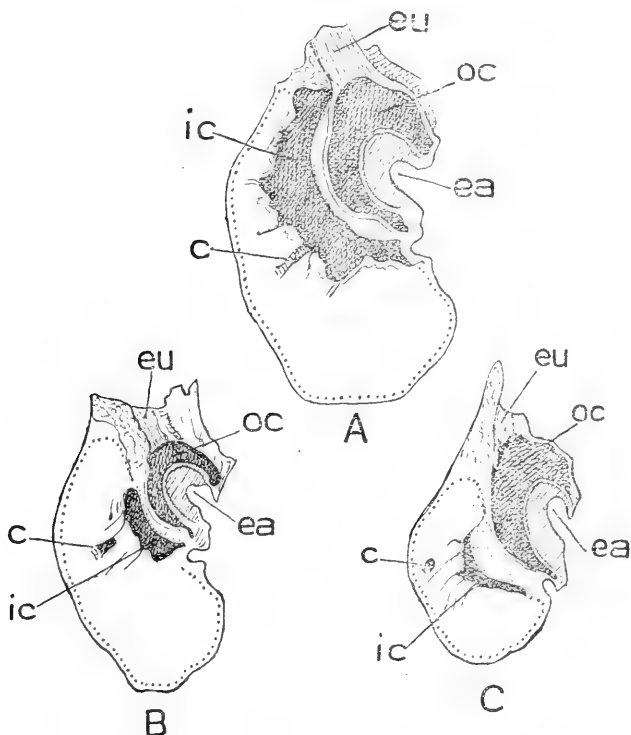


- A. Right tympanic bulla of *Uncia uncia* seen from the inner side, with the wall of the inner chamber cut open from the summit to the basioccipital. *p*, partition between the chambers; *per*, periotic bone against which the partition abuts; *m*, mastoid; *pocc*, paroccipital; *c*, condyle; *d*, depression on basioccipital.
- B. The same of *Panthera onca*. The crest rising from the posterior end of the partition marks the stylomastoid groove.

In some half-dozen skulls of *F. pardus* from Asia and Africa there is no great variation in the internal structure of the bulla. In all cases the ridge formed on the wall of the

posterior chamber by the stylomastoid groove is distinct from the low partition and runs upwards, when the skull is inverted, from its posterior end. The same applies to two skulls of *F. onca* (fig. 3 B) and to four of *F. tigris*. But in

Fig. 4.



A. Right bulla of *Panthera leo* extracted and viewed from its upper, or attached, surface, part of the roof of the inner chamber cut away. *c*, carotid groove; *eu*, floor of eustachian tube; *ea*, external auditory meatus with horseshoe-shaped tympanic bone; *oc*, outer or auditory chamber separated by the partition from inner chamber (*ic*), the extent of which is indicated by the dotted line following the contour of the bulla.

B. The same of *Panthera pardus* (from India), but the roof left intact.

C. The same of *Uncia uncia*.

three skulls of *F. leo* the partition is somewhat higher and longer, and the auditory chamber consequently a little larger relatively (fig. 4 A).

*The Classification and Generic Nomenclature of F. uncia
and its Allies.*

In the paper already quoted, I have shown that the five species here discussed differ from other existing species of Felidæ in the structure of the hyoid apparatus. To this character, at all events, generic value should be given. But it appears to me that the combination of cranial features exhibited by *F. uncia*, particularly in the occipital and auditory bones, entitles that species to generic separation from *F. leo*, *tigris*, *pardus*, and *onca*, the skulls of which differ in comparatively minor points from each other and show many cross-resemblances.

The view that the external differences observable between these species in coloration and hair-growth are worth generic recognition does not appeal to me. For example, Gray adopted the generic name *Leo* for *F. leo* mainly on the strength of the secondary sexual characters, which he knew to be exceedingly variable in development racially or individually, although he was not aware that they are sometimes not developed at all*; and, as regards pattern, I have elsewhere shown † that the markings of *F. leo*, as exhibited by the cubs, sometimes show a complete transition between the stripes of *F. tigris* and the spots of *F. onca* or *pardus*, although usually, when visible, which is not always the case, approaching the rosette type exhibited by the two last mentioned species.

Nevertheless, since the tendency of modern systematic mammalogy has found in the present instance expression in the admission of many species of leopard, lion, jaguar, and tiger, it is possible, perhaps probable, that the logical outcome of that process—namely, the ascription of generic rank to each of these animals—will be followed in the future. If that be so, nominal symbols are available for them.

Rejecting the validity of *Leo* and *Tigris*, published by Frisch in 1775 ‡, it seems that Oken was the first author to introduce generic terms for the leopard, tiger, and lion. By pagination the following is the order of their publication:—

Panthera, Oken, Lehrb. Zool. 2nd Abth. pp. 1052–1066

* Col. Patterson's man-eating lions of Tsavo were described as maneless, and, judging from his photographs, they were not distinguishable, so far as the mane is concerned, from lionesses.

† Ann. & Mag. Nat. Hist. (7) xx. p. 436 (1907).

‡ Following the decision of Sherborne and of Thomas and Miller, Ann. & Mag. Nat. Hist. (7) xvi. p. 461 (1905).

(1816). With other species were included *vulgaris* = *pardus*, Linn.; *americana* = *onca*, Linn.; *alba* = *uncia*, Schreb. Of these, *pardus* is the type, according to Allen's decision (Bull. Amer. Mus. Nat. Hist. xvi. pp. 377-378, 1902).

Tigris, Oken, *tom. cit.* pp. 1066-1070; type by tautonymy *tigris*, Linn. (Palmer, 1904).

Leo, Oken, *tom. cit.* pp. 1070-1076; type by tautonymy *leo*, Linn. (Palmer, 1904).

Furthermore, the following names are available for the remaining two species of large cats which come into this group:—

Uncia, Gray, Ann. & Mag. Nat. Hist. (2) xiv. p. 394 (1854); type by tautonymy *uncia*, Schreb.

Jaguaris, Severtzow, Rev. Mag. Zool. (2) x. pp. 386 & 390 (1858), proposed as a subgenus of *Panthera* for *F. onca*, Linn., which is its type.

It does not appear to me that these conclusions, which are set forth in Palmer's 'Index Generum Mammalium,' 1904, are open to dispute.

Adopting, then, the view here advocated, that *F. uncia* is entitled to generic distinction from *F. leo*, *tigris*, *pardus*, and *onca*, it will take the name *Uncia*; while, for the category composed of the remaining four species, *Panthera* is by page priority in Oken's work the correct title, with *Tigris*, *Leo*, and *Jaguaris* as synonyms according to the system I adopt*.

The only other name which might possibly be claimed as superseding *Panthera* is *Leopardus*, Forskål (Descr. Anim. etc. p. v, 1775). This name, however, was published without citation of genotype. It was followed merely by the Arabic name *nimr*, which clearly cannot be regarded as a specific title in a zoological sense. In the Arabic tongue it probably embraces both the leopard (*pardus*) and the cheetah or hunting leopard (*jubatus*). At all events, according to Tristram ('Nat. Hist. of the Bible,' ed. 9, 1898, p. 114) the Hebrew term *namer* "doubtless comprehended both these species" †.

* In Agassiz's 'Nomenclator' and Palmer's 'Index' the name *Panthera* is alleged to have been given by Hübner to a genus of Lepidoptera in 1816, thus synchronizing with Oken's publication. I am indebted, however, to Mr. Oldfield Thomas for the information that 1816 for Hübner's work is a misprint for 1826. Thus the way is cleared for the adoption of *Panthera*, Oken.

† Mr. Oldfield Thomas and Mr. Knud Andersen concur in the rejection of *Leopardus*, Forskål.

It may be added that Matschie's classification of these large Felidæ as *Uncia* for *leo*, *tigris*, and *concolor* and *Leopardus* for *pardus*, *uncia*, and *onca* (SB. Ges. Nat. Fr. Berlin, 1895, pp. 198-199)—a classification which was adopted by Trouessart in 1904 (Cat. Mamm., Suppl. p. 265)—is quite indefensible both from the zoological and nominal standpoints. The valuelessness of Matschie's opinion on the question of the affinities of the species concerned is attested by his regarding *uncia* as a subspecies of *pardus* and by his placing *concolor* with *tigris* and *leo* in a genus from which *pardus* and *onca* are excluded. It cannot be doubted that the relationship between *onca* and *pardus* is greater than that between *uncia* and *pardus*, and that *tigris* is much more nearly akin to *pardus* than it is to *concolor*. Yet Matschie's classification implies the precise opposite of these conclusions. And as regards his choice of names, *uncia* by tautonymy, let alone the selective actions of Severtzow and Gray, is the type of *Uncia* and *Leopardus*, rejecting Forskål's work, is not admissible either for *pardus* or *onca* or *uncia*, since none of these species was included when it was first proposed by Gray in 1842 (Ann. & Mag. Nat. Hist. x. p. 260). It was applied to *griseus*, *pictus*, *elliotti*, and *horsfieldi*. Since one of these must be the type, I select *griseus*, which probably connotes a subspecies of *pardalis*. That Gray intended *pardus* to come into *Leopardus* is shown by his subsequent writings; but there seems to be no defensible pretext for its admission, gratifying as it would be to relegate *Leopardus* to the synonymy of *Panthera*.

The principal cranial differences between *Uncia* and *Panthera* may be briefly contrasted as follows:—

- | | |
|--|-------------------------|
| <p>a. Outer chamber of the bulla very large and involving the whole of the anterior portion of its cavity, the line of the partition remote from the meatus and running from the stylomastoid foramen to a point on the inner surface close to the basioccipital suture; a narrow valley between the bulla and the glenoid joint; basioccipital deeply excavated laterally, a deep pit at the anterior end of the excavation</p> | <p><i>Uncia.</i></p> |
| <p>b. Outer chamber of bulla comparatively small, not involving the whole of the anterior portion of the cavity; the partition-line close to the meatus and ceasing towards the anterior edge of the bulla; a wide valley between the bulla and the glenoid joint; basioccipital at most shallowly excavated laterally</p> | <p><i>Panthera.</i></p> |

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XXXVII.—*The Scales of the Brotulid Fishes.*

By T. D. A. COCKERELL, University of Colorado.

IN the 'Proceedings of the Biological Society of Washington,' vol. xxvi. (1913) p. 76, I gave a brief account of the scales of two species of Brotulidæ. Since that time, thanks to the kindness of Dr. Hugh M. Smith, I have been able to study the scales of numerous species of this family, and thus gain some idea of the range of modification and the general scale-characters of the group. In the synopsis which follows it will be seen that the subfamilies can usually be distinguished by scale-characters; but the Bythidinæ are not sharply differentiated from some of the Neobythitinæ. *Neobythites* and *Dicrolene*, with numerous species, possess scales of a very uniform type, little modified from what we may suppose to have been the primitive pattern of the group. The tribe Bassozetini, with the radii absent or greatly reduced, must be looked upon as a specialized, not a primitive, group. This idea, based at first on the study of the scales, appears to be confirmed by the other characters of the fishes. The Lucifugine scale must be looked upon as a rather degenerate member of a primitive series. *Brotula* appears to have a primitive type of scale, but distinct in minor details, and not to be very closely associated with the Neobythitinæ.

We are naturally led to ask, What characters have Brotulid scales in common with those of the Ophidiidæ? The general type of scale is quite the same, with coarse circuli, and numerous radii all around. There is no network

or system of lines between the circuli in the apical field, even in latinucleate scales. The following synopsis separates the Ophidian types studied:—

- Scales small (much less than 2 mm. long),
elongate or long-oval, with rounded
ends; nucleus central or nearly so; radii
strongly zigzag.
- Scales larger and broader *Rissola marginata* (New
York; U.S.N.M.).
- Scales smaller, with flatter sides *Ophidion vassali* (Mes-
sina; U.S.N.M.).
- Scales variously shaped; nucleus basad of
middle; radii not, or not strongly, zigzag. 1.
1. Scales variable in form, but usually dis-
tinctly triangular; nucleus subbasal.... *Genypterus blacodes*
(Tasmania; Brit. Mus.).
- Scales not at all triangular or pyriform 2.
2. Scales very small; very broad-oval, not very
far from circular; nucleus basad of
middle, but not very near base; radii
comparatively few, undulate *Lepophidium emmelas*
(Pacific Ocean; U.S.N.M.).
- Scales larger; oblong or long-oval; nucleus
subbasal 3.
3. Scales small, about 1.50 to 1.75 mm. long;
apical radii undulate *Lepophidium cervinum*
(Albatross Sta. 2591; U.S.N.M.).
- Scales larger, over 2 mm. long, some 2.50;
apex much broader and more obtuse .. *Lepophidium microlepis*
(Albatross; U.S.N.M.).

The stem form here would seem to be *Lepophidium*, the scales of which are constructed as in *Brotula*, except that the sculpture is relatively much less dense, and the separate elements are rather differently shaped. The elements are, however, essentially alike in character; quadrate, with a median transverse ridge. It seems impossible to find any salient general characters to separate Ophidiid from Brotulid scales. The scales suggest that perhaps *L. emmelas* should be generically separated from the other species. It may be, however, that my material is immature.

Zoarces viviparus (Baltic; U.S.N.M.) has small broad-oval scales, with central nucleus, coarse circuli, and radii all around. There is here a general resemblance to *Ophidion* or *Rissola*, but the scales are less elongate and the radii are not zigzag. The almost straight, continuous, rather widely spaced radii at once distinguish *Zoarces* from *Stygicola* and *Hephthocara*.

I have previously called attention to the great resemblance between the scales of Brotulidæ and those of certain genera

of Gadidæ. Scales of *Lepophidium microlepis* are constructed quite in the same manner as those of *Microgadus tomcod*. *Gadus esmarkii* (Norway; Collett, U.S.N.M.) differs by the shorter elements or denser circuli. Other Gadids are entirely different; thus *Physiculus* (*japonicus* and *nigrescens*) has the basal circuli all longitudinal, in the manner of *Bregmaceros*, though the scales are otherwise very different from that genus, having the apical circuli wrinkled or labyrinthiform, and no radial ribs between the circuli, or radii of any sort. Thus, with scales alone, we should commit the error of associating *Microgadus* and its allies with the Ophidiids and Brotulids, much more closely than with such Gadids as *Physiculus*.

Brotulidæ.

- Scales circular or nearly, with radii all around, but these irregular and largely broken 1.
- Scales elongate, or, if almost circular (*Glyptophidium*), the lateral radii curved, so that their apical parts are at right angles to the latero-basal radii, which is not true of the genera under the opposite alternative 2.
1. Scales very small, less than 1 mm. broad *Lucifuginæ*.
Scales larger, over 2 mm. broad *Hephthocarinae*.
2. Scales very elongate; the extremely numerous radii forming with the circuli a network the meshes of which, except toward the periphery, are quadrate or diamond-shaped, and are not broken up by fine lines forming a secondary, more minute network *Brotulinae*.
- Scales elongate or broad-oval; when the radii and circuli form a network, the meshes are short and transverse, or, if subquadrate (*Bassogigas* and *Neobythites*), are broken up by fine lines into a secondary network 3.
3. Scales broad-oval or oblong, with radii all around, the lateral ones curved *Bythitinae*.
Scales broad-oval, or oblong, or elongate; radii well developed, or nearly or quite absent *Neobythitinae*.

LUCIFUGINÆ.

Stygicola dentata (Poey). Cuba (U.S.N.M.).

The minute circular scales have the nucleus practically central, and the coarse circuli broken into segments by the irregular radii. Some of the smaller scales are oval. Except for the radii, there is a general resemblance to the scales of *Lota*.

HEPHTHOCARINÆ.

Hephthocara crassiceps, Smith & Radcliffe. Type. Buton Strait (U.S.N.M.).

The nearly circular scales are much larger than those of *Stygicola*, but similar in structure, though the sculpture is relatively finer. The nucleus is distinctly away from the middle.

BROTULINÆ.

Brotula maculata scales are described in Proc. Biol. Soc. Washington, xxvi. p. 76. They are quite distinct from those of all other Brotulids seen.

BYTHITINÆ.

Scales small, broad-oval	1.
Scales larger, oblong	2.
1. Radii more numerous	<i>Catætyx</i> .
Radii less numerous	<i>Xenobythites</i> .
2. Radii linear	<i>Grammonus</i> .
Basal radii broadened, widely interrupting the circuli	<i>Diplacanthopoma</i> .

Catætyx platycephalus, Smith & Radcliffe. Type. Molucca Passage (U.S.N.M.).

Scales broad-oval, about 2 mm. long and 1.5 broad; nucleus a little anterior to middle; radii numerous, the lateral ones curved.

Xenobythites armiger, Smith & Radcliffe. Type. Mindanao (U.S.N.M.).

Scales broad-oval, a little over 1 mm. long, about .75 broad; lateral radii strongly curved. This is quite of the same general type as *Catætyx*.

Grammonus robustus, Smith & Radcliffe. Type. Between Cebu and Leyte (U.S.N.M.).

Scales oblong, 2.5 to nearly 3 mm. long, 1.70 to 2 broad, the sides more or less flattened; radii very numerous, linear; nucleus at or near the middle.

Diplacanthopoma brunnea, Smith & Radcliffe. Type. Palawan Passage (U.S.N.M.).

Scales oblong, about 2.75 mm. long and 2 broad; nucleus

distinctly apicad of middle; radii numerous, the basal ones broad hyaline lanes between the interrupted circuli.

The Bythitinæ, as restricted by Radcliffe, seem rather closely allied on scale-characters; *Diplacanthopoma* is the most distinct of the genera examined. On the other hand, I am at a loss to separate the Bythitinæ on scale-characters from the group of Neobythitinæ typified by *Glyptophidium*. The *species* of Bythitinæ may be separated from those of Neobythitinæ on comparison of scales, but there is no general or important character to separate the subfamilies.

NEOBYTHITINÆ.

- | | | |
|--|----|--------------------------------|
| Radii absent or greatly reduced (tribe Bassozetini) | 1. | |
| Radii well developed | 2. | |
| 1. Scales small, 2 mm. long or less; rudiments of basal radii, or radii absent, but apical circuli connected by fine lines | | <i>Eretmichthys.</i> |
| Scales large, over 4 mm. long; distinct basal radii, of the type of those in <i>Diplacanthopoma</i> , and occasional rudiments of apical radii; a secondary network of fine lines in apical field .. | | <i>Bassozetus robustus.</i> |
| Scales very large, about 8 mm. long and 5·25 broad, nucleus a little below middle; no radii; minute reticulation of apical field very distinct | | <i>Bassozetus elongatus.</i> |
| 2. Scales elongated; nucleus above the middle; basal radii separated from lateral, which have a quite different direction, or lateral radii absent (tribe Monomitopini) | 3. | |
| Scales broad-oval or elongated; radii all around, not or hardly modified | 5. | |
| 3. Lateral radii absent | | <i>Monomitopus microlepis.</i> |
| Lateral radii present | 4. | |
| 4. Lateral radii feebly developed | | <i>Monomeropus garmani.</i> |
| Lateral radii well developed, but very widely spaced | | <i>Monomitopus pallidus.</i> |
| 5. Scales broad-oval or subquadrate | 6. | |
| Scales more elongate | 7. | |
| 6. Scales small, regularly oval; nucleus well basad of middle | | <i>Barathrodemus.</i> |
| Scales larger, more or less quadrate | | <i>Glyptophidium.</i> |
| 7. Network of radii and circuli in apical field forming transversely elongated areas, not broken up by a secondary reticulation of fine lines*; nucleus far basad . | 8. | |

* Latinucleate scales of *Homostolus* show this feature, however.

- Network of radii and circuli in apical field forming quadrate or subquadrate spaces, broken up by a secondary network of fine lines. 9.
8. Radii more numerous *Hypopleuron*.
Radii less numerous *Homostolus*.
9. Scales rather oblong, not twice as long as wide *Bassogigas*.
Scales longer *Neobythites* & *Dicrolene*.

Judging from the scales, it appears that *Eretmichthys* and *Bassozetus* form a very distinct group; *Monomitopus* and *Monomeropus* also stand together well apart from the rest of the subfamily. These should be regarded as distinct tribes, at least. The other genera seem to be more closely related, forming all together a single fairly compact group.

Eretmichthys remifer, Smith & Radcliffe. Type. Celebes (U.S.N.M.).

Scales from caudal region oval, 2 mm. long or less; circuli not very dense; nucleus a little apical of middle.

Bassozetus robustus, Smith & Radcliffe. Type. Palawan Passage (U.S.N.M.).

Scales long-oval; nucleus near the middle.

Bassozetus elongatus, Smith & Radcliffe. Type. Celebes (U.S.N.M.).

This seems subgenerically distinct from *B. robustus*.

Monomitopus microlepis, Smith & Radcliffe. Type. Between Cebu and Leyte (U.S.N.M.).

This appears to be very distinct from the other species. The scales are about 2.75 mm. long and 1.25 broad, with the lateral radii absent, or at most represented by broken rudiments. The latero-basal radii are curved, and, although there are 14 to 20 basal radii, they run into one another, and only 3 or 4 reach the nucleus. The system of fine lines between the circuli in the apical field is rather poorly developed.

Monomitopus pallidus, Smith & Radcliffe. Type. Between Mindoro and Panay (U.S.N.M.).

Scales 3 to 3.25 mm. long and about 1.70 broad; basal radii more parallel than in *M. microlepis*, more reaching the nuclear region; widely spaced but very distinct lateral radii,

at right angles to the latero-basal, or rarely continuous with a latero-basal, making a large L; lateral system of radii continued across the apical field, so that there are radii all around; fine lines between circuli in apical field usually well developed, though they may be absent when the nucleus is far apicad.

Monomeropus garmani, Smith & Radcliffe. Type. Celebes (U.S.N.M.).

Scales nearly 4 mm. long and slightly over 2 broad, rather parallel-sided and truncate at ends; nucleus considerably above the middle; about 15 basal radii, few reaching nucleus; lateral and apical radii very feebly developed; apical field with the lines or network between the circuli very well developed. These scales are quite of the same general type as those of *Monomitopus*. *Monomeropus* is, perhaps, not more than a subgenus.

Barathrodemus nasutus, Smith & Radcliffe. Type. Celebes (U.S.N.M.).

Scales broad-oval, rather over 2 mm. long and 1.5 wide; numerous radii all around; nucleus basad of middle. This differs greatly from the *Monomitopus* group by the position of the nucleus and wide spread of the basal radii.

Glyptophidium lucidum, Smith & Radcliffe. Type. Between Gillolo and Kayoa Is. (U.S.N.M.).

Dorsal scales about 4.5 mm. long and 3.75 broad. The only one I obtained is latinucleate, but it shows rather widely spaced radii all around. I cannot distinguish it from the scales of *G. oceanium*, although the two fishes seem to be subgenerically distinct.

Glyptophidium oceanium, Smith & Radcliffe. Philippine Is. (U.S.N.M.).

I took a loose scale from the dorsal surface of the type, but on examination it proved to be that of some Macrurid. Dr. H. M. Smith kindly sent me several lots of scales subsequently, clearly establishing their character. The scales are rather large, more or less quadrate, but very variable in shape, with the nucleus about the middle or nearer the base. There are linear radii all around, and the lateral ones tend to be strongly curved basally, so that they diverge nearly at

right angles from the direction of the basal radii. This may, perhaps, be taken as an indication that the fish has evolved from a type with long scales. There is no secondary network or system of lines between the circuli in the apical field. Although *Glyptophidium* and *Barathrodemus* are linked together on account of the shape of their scales, they appear to represent quite independent developments, the details of the sculpture being different.

Hypopleuron caninum, Smith & Radcliffe. Type. Near Kayoa I. (U.S.N.M.).

Scales about 3 mm. long and 2 wide, rather oblong, but variable in form; very numerous radii all around; nucleus far toward the base; apical field without fine lines or network between the circuli; lateral and basal radii spreading from the nucleus, without bend or dislocation. Except in shape, these scales have no resemblance to those of *Merluccius*, which resembles *Hypopleuron* in the remarkable modification of the vertebræ.

Homostolus acer, Smith & Radcliffe. Type. Mindanao (U.S.N.M.).

Scales about 4 mm. long and 2.5 broad, or smaller and narrower; nucleus far toward base; radii all around; normal scales have no lines or network between the circuli in apical field, but latinucleate scales have a fine network apical of the nuclear area. The lateral circuli opposite the nucleus are directed obliquely upward; in *Hypopleuron* they are directed outward or only a little obliquely. The circuli are much denser than in *Neobythites*.

Bassogigas æquatoris, Smith & Radcliffe. Type. Celebes (U.S.N.M.).

Scales oblong, 3-3.5 mm. long, 2-2.25 broad; nucleus subbasal; radii all around, lateral not bent, but many incomplete; apical region with a fine secondary network. The subbasal nucleus at once separates this from the scales of the Bythitinae.

Neobythites steaticus is described in Proc. Biol. Soc. Wash. xxvi. p. 76.

The species of *Neobythites* have elongated scales with broadly rounded ends; nucleus far basad; radii numerous,

all around, no break between the lateral and basal series; apical field with a fine network between the circuli. *N. longipes*, Smith & Radcliffe, *N. purus*, Smith & Radcliffe, and *N. fasciatus*, Smith & Radcliffe, have exactly the same pattern as *N. steaticus*.

* *Dicrolene* scales (*D. longimana*, Smith & Radcliffe; *D. tristis*, Smith & Radcliffe, *D. intronigra*, Alcock) do not differ from those of *Neobythites*.

D. intronigra is remarkable for the length of the scales, which are about 4.25 mm. long and 2 broad. In *D. tristis* they are about 3.75 mm. long. Many of the scales of *Neobythites* and *Dicrolene* are latinnucleate.

A note should be added with reference to *Bregmaceros*. In Proc. Biol. Soc. Wash. xxvi. p. 77, I was certainly in error with reference to the "squarish to suboval plates," which appear, in good dry material, to be really depressions. They, therefore, have nothing to do with the veritable transversely ridged plates of *Gadus*, the Ophidiids, and Brotulids, which really are distinct elements, and in some mounts can be seen as distinct entities, separate from the scales to which they were attached. *Bregmaceros japonicus* (Misaki, Japan; Stanford University) shows exactly the same features as *B. atripinnis*, except that the very broad scales have no angulation of the circuli in the middle line above.

Aside from the question of *Bregmaceros*, it now appears certain that the theory of Tims, that scales arose from the fusion of separate placoid-like elements, is incorrect. In the remarkable shark *Eridacnis radcliffei*, Smith, the scales are arranged in rows exactly as in Teleosts; and although they are of course placoid, with a central spine, they are broadly expanded laterally, and the expanded portions have a minute reticular sculpture. The sculpture on the *Eridacnis* scale is, however, represented by lines enclosing hexagonal areas, which are more or less narrowed at either end, and are placed so that the middles of those of one row approximately correspond to the ends of those of the rows adjacent. There is here a distinct resemblance to the sculpture of Cæciliid (Amphibian) scales. Granting that placoid scales are exceedingly different from those of Teleosts, as shown by Goodrich and others, they, nevertheless, surely represent essentially homologous structures.

XXXVIII.—*The Structure of the Auditory Bulla in existing Species of Felidæ.* By R. I. Pocock, F.R.S., Superintendent of the Zoological Society's Gardens*.

FOR distinguishing the genera and species of Felidæ a great variety of cranial characters have been employed. One, however, seems to have escaped altogether the attention of systematists—namely, the size and position of the partition dividing the tympanic bulla into two chambers.

It may be recalled that the partition arises on the inner side of, and below, the tympanic annulus, and ascends towards the periotic bone, with which its free margin is in contact, or almost in contact, except posteriorly close to the fenestra rotunda. It thus cuts off the outer or auditory chamber of the bulla from the inner and posterior larger chamber except where the fenestra rotunda perforates the periotic, at which point there is a passage from the outer to the inner chamber. The posterior end of the partition is, to all intents and purposes, a fixed point, marked on the outside of the bulla by the stylomastoid foramen and on the inside usually by a ridge of bone formed by the indentation of the stylomastoid groove. But the position of the line of origin of the partition below the tympanic annulus and its anterior termination vary considerably in different species; and the variations in these respects have a profound effect upon the relative sizes of the two chambers. When the partition rises close to the annulus and extends only slightly beyond the part of the periotic exposed within the bulla, the outer or auditory chamber is small and the inner chamber is large. Conversely, when it rises some distance below the annulus and passes forwards well in advance of the exposed portion of the periotic, the outer chamber is enlarged at the expense of the inner chamber. The line of the origin of the partition is generally marked on the outer surface of the bulla by a shallow groove, curving forwards from the stylomastoid foramen.

I have recently pointed out † that the skull of the Snow Leopard or Ounce (*Uncia uncia*) differs very considerably from that of the Leopard (*Panthera pardus*), the Jaguar (*P. onca*), the Tiger (*P. tigris*) and the Lion (*P. leo*), in the

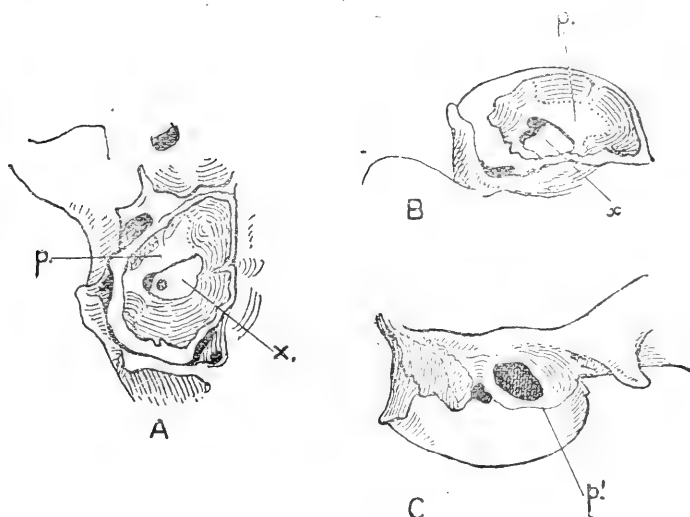
* The materials upon which the observations recorded in this paper are based are a series of skulls belonging to the Zoological Society, supplemented, mainly, so far as the external features of the bulla are concerned, by the skulls in the collection of the British Museum.

† Ann. & Mag. Nat. Hist. ser. 8, vol. xxxviii., Sept. 1916.

height and direction of this partition and in the relatively large size of the outer or auditory chamber; and I find that similar differences are observable between certain other species of Felidæ.

In *Felis aurata*, *temminckii*, *marmorata*, *planiceps*, *viverrina*, *nebulosa*, *concolor*, *pardalis*, *wiedii*, and other tropical, or mainly tropical, species the bulla with its low partition, small outer chamber, and capacious inner chamber conforms, in a general way, to the type I have described and figured in

Fig. 1.



Felis pardalis. (No precise locality.)

A. Right bulla, from below, with inner chamber laid open.

B. The same, from inner side.

C. The same, from outer side.

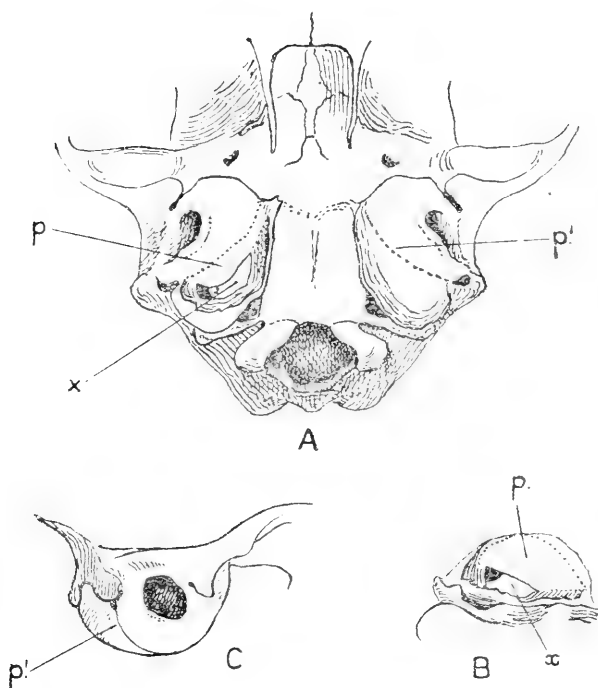
p., partition; x., periotic; p', line of origin of partition.

Panthera onca. In *F. pardalis*, for example, the groove on the outer side of the bulla is close to the inferior margin of the auditory meatus, and within the inflated inner chamber the partition is very low posteriorly where it passes into the stylomastoid ridge and increases a little in height anteriorly, almost the entire space of the bulla being occupied by the inner chamber (fig. 1).

The opposite extreme in the structure of the bulla is exhibited by *F. manul* (fig. 2), in which the groove marking

the line of the partition runs from the stylomastoid foramen obliquely inwards and forwards across the summit of the inverted bulla and ceases at the occipito-sphenoidal suture. The partition, which is almost vertical, divides the bulla into two approximately equal chambers, of which the outer, or auditory, occupies the whole of the anterior portion of

Fig. 2.



Felis manul. (Tibet.)

- A. Base of skull, from below, with inner chamber of right bulla laid open.
 B. Right bulla of same, from inner side.
 C. The same bulla, from outer side.

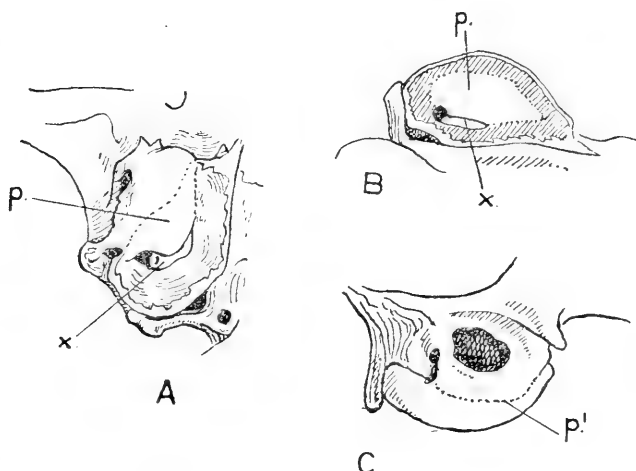
p., partition; *x.*, periotic; *p'*, line of origin of partition.

the bulla, the inner or posterior chamber ceasing in front at the occipito-sphenoidal suture, where it is compressed to form an acutely angular corner. *F. manul*, indeed, surpasses *Uncia uncia* in the enlargement of the outer at the expense of the inner chamber, since in *Uncia* the line of origin of the partition does not reach the summit of the

bullæ and the anterior extremity of the inner chamber is less narrowly compressed.

A species which agrees very nearly with *F. manul* in the structure of the bulla is *F. pajeros*, allowance being made for the greater expansion of the inner chamber posteriorly—a feature observable, by the way, in many of the smaller and medium-sized American Felidæ as compared with tropical African and Asiatic species. *F. manul* and *F. pajeros*, indeed, differ from all the other species of *Felis*

Fig. 3.



Felis canadensis. (No precise locality.)

- A. Right bulla, from below, with inner chamber laid open.
- B. The same, from the inner side.
- C. The same, from the outer side.

p., partition; *x.*, periotic; *p'*, line of origin of partition.

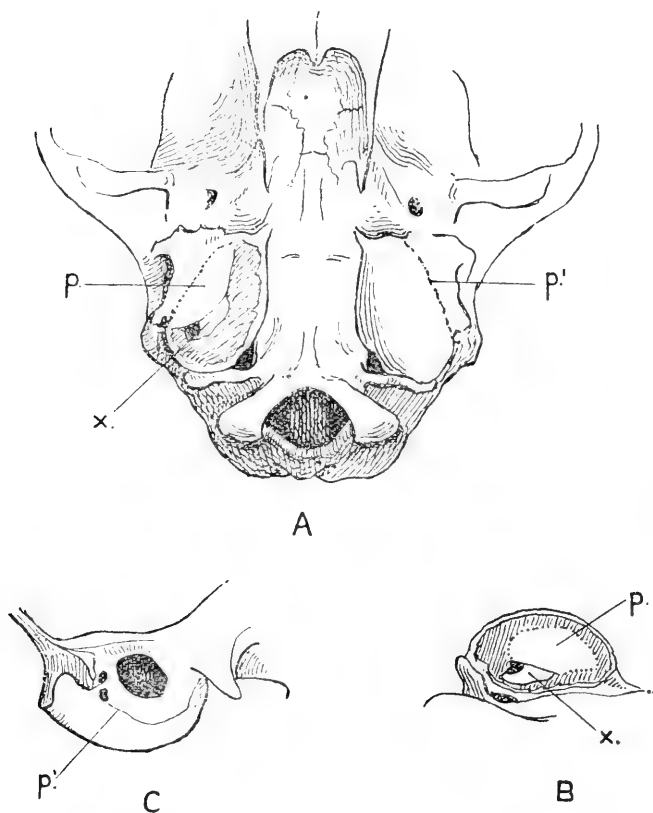
whose bullæ I have examined in the extension of the outer auditory chamber well in advance of the inner chamber.

Between the extremes presented by the bullæ of *F. manul* and *F. pardalis*, for example, there is almost every gradation in the size of the partition and of the relative dimensions of the two chambers.

In the skulls that I have examined, two that come nearest to *F. manul* and *F. pajeros* are those of *Felis lynx* (or *Lynx lynx*) *isabellina*. But in these, the partition, though large, does not reach the summit of the bulla and terminates in front

towards the inner angle of the anterior edge of the bulla. The outer chamber extends slightly more forwards than the anterior end of the inner chamber, which in front forms a narrow passage between the partition and the wall of the

Fig. 4.



Felis sylvestris. (Scotland.)

- A. Base of skull, from below, with inner chamber of right bulla laid open.
 B. Right bulla of the same, from inner side.
 C. The same, from outer side.

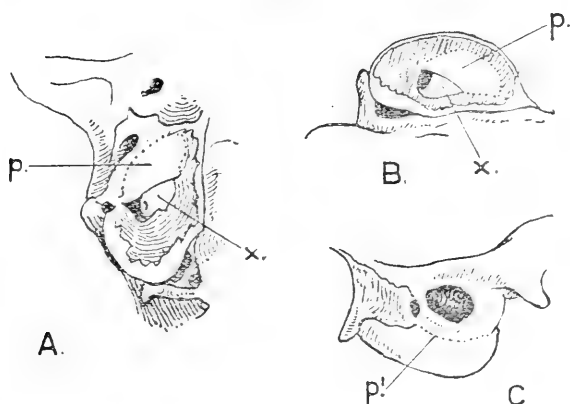
p., partition; *x.*, periotic; *p'*, line of origin of partition.

bullæ owing to the encroachment of the partition on the chamber at this point. The bullæ of two specimens of *F. canadensis* (fig. 3) differ rather unexpectedly from those

of *isabellina* in the particulars just mentioned—that is to say, the partition does not advance so far internally in front, so that the anterior portion of the inner chamber is much broader. On the other hand, the posterior portion of this chamber is less capacious. One skull of *F. rufa*—or a closely related form—agrees substantially in the structure of the bulla with those of *F. canadensis*.

The bullæ of several examples of *F. caracal* agree closely with those of *F. rufa* and *canadensis*, except that the posterior chamber is relatively more capacious and the outer chamber slightly less so.

Fig. 5.

*Felis geoffroyi.* (La Plata.)

- A. Right bulla, from below, with inner chamber laid open.
 B. The same, from the inner side.
 C. The same, from the outer side.

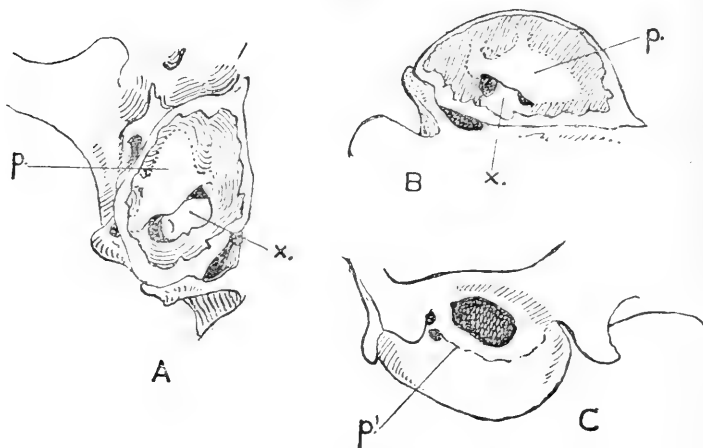
p., partition; *x.*, periotic; *p.*', line of origin of partition.

Resembling the lynxes in varying degree, according to the species, are the cats belonging to the genus *Felis* in the strict sense of the word—namely, *F. ocreata*, *sylvestris*, *ornata*, *chaus*, *nigripes*, and their allies (fig. 4). In this group the partition is relatively as high and as large in *nigripes* as it is in lynxes and is considerably larger than in *ocreata*, *ornata*, and *sylvestris*. In *chaus* it is still smaller. But in all cases the partition is very noticeably larger and rises higher above the crest of the tympanic annulus than in *pardalis*, *nebulosa*, *planiceps*, *marmorata*, and others which resemble *Panthera pardus* and *onca* in having a low partition

shutting off a very small outer chamber from a capacious inner chamber.

Other stages in the intergradation between these two types of bullæ are shown by *F. geoffroyi* and *F. serval*. In *F. geoffroyi* (fig. 5) the partition rises about the same distance below the rim of the auditory meatus as in *F. chaus*, and is only a little shallower at its deepest point than in that species; but it is much shallower at its posterior end below, or, when the skull is inverted, above the periotic orifice between the chambers. From the figure, moreover, it will be seen that the partition lies much farther forwards within

Fig. 6.



Felis serval, var. *servalina*. (Uganda.)

- A. Right bulla, from below, with inner chamber laid open.
 B. The same, from inner side.
 C. The same, from outer side.

p., partition; *x.*, periotic; *p'*, line of origin of partition.

the cavity of the bulla than in *F. sylvestris*, with which *F. chaus* agrees, and that the inner chamber is produced and capacious posteriorly as in *F. pardalis* (compare figs. 1 and 5).

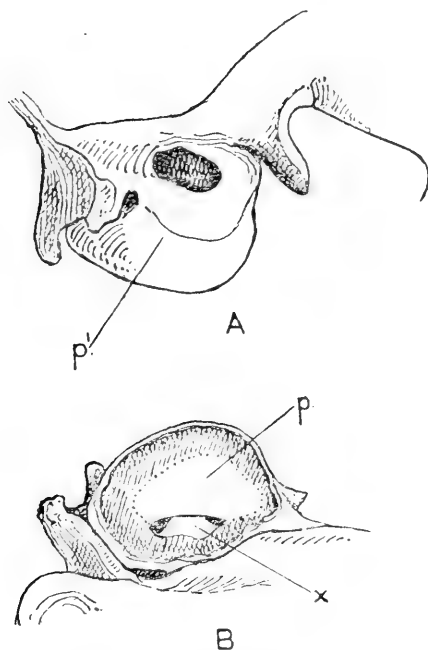
In *F. serval* (fig. 6) the position of the partition within the bulla, and the degree of inflation of the inner chamber posteriorly agree with the condition seen in *F. chaus* and *F. sylvestris*; but the partition is lower, especially behind, than in *F. chaus*, and rises close beneath the rim of the auditory meatus.

Finally, in the genus *Acinonyx*, better known as *Cynailurus*,

the structure of the bulla and the height of the partition agree, broadly speaking, with those of the lynxes and of the species of the *Felis* group in the restricted sense of that term (fig. 7).

Another point worth attention is the apparent correspondence, partial at all events, between the structure of the bulla and the habitat of the species. Although in the

Fig. 7.



Acinonyx jubatus. (Brit. E. Africa.)

A. Right bulla, from outer side.

B. The same, from inner side, with inner chamber laid open.

p., partition; *x.*, periotic; *p'.*, line of origin of partition.

present state of our knowledge, it is impossible to make a general statement on the matter, a review of the facts suggests that, broadly speaking, the species with a low partition and a very small outer or auditory chamber inhabit forest or jungle, whereas those with a high partition and large outer chamber frequent open country. For instance, *Felis manul*, *Lynx isabellinus*, and *Uncia uncia* occur in rocky

situations in Central Asia, *F. pajeros* in the pampas of S. America, *F. caracal* and *Acinonyx jubatus* in the sandy or grassy plains of Africa and tropical Asia. All of these species have a comparatively high partition and large outer chamber. On the other hand, *Panthera pardus* and *onca*, *Felis pardalis*, *nebulosa*, *marmorata*, *aurata*, and others with a very low partition and small outer chamber are essentially dwellers in thick forest. *F. concolor*, however, is apparently exceptional. In the skulls examined the partition is as low and the outer chamber practically as small as in the typical forest and jungle species. Nevertheless, this cat, as is well known, lives both in swampy jungles and in high rocky hills. I have not seen sufficient numbers of skulls to know whether or not there is any variation in the bulla according to the habitat; but in view of the above-mentioned facts, I should infer that the puma has comparatively recently adapted itself to open-country conditions.

This brief enumeration of the main facts is sufficient to establish some interesting conclusions. First, that within the limits of the species, or genera, of Felidæ intergradation exists in the size and position of the partition and the relative capacity of the two chambers of the bulla. Second, that the structure of this part of the skull cannot by itself be regarded as evidence of affinity between species, as is shown by the similarity between such evidently unrelated forms as *Felis manul* and *F. pajeros* and *Uncia uncia*. Third, that species which for other reasons must be regarded as allies—namely, those belonging to *Felis*, in a restricted sense of the word (such as *sylvestris*, *oreata*, *chaus*), and the lynxes (*L. lynx*, *canadensis*, and *caracal*)—have bullæ of a similar type, varying a little according to the species.

XXXIX.—*Two new Species of Akodon from Argentina.*

By OLDFIELD THOMAS.

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Akodon dolores, sp. n.

A rather large coarsely lined brown species.

Size about as in *A. obscurus*. General colour a uniform pale olive-brown (darker than “drab” of Ridgway, paler than “olive-brown”), not nearly so olivaceous as in *arenicola*

and its allies, rather coarsely lined on the back with the ends of the darker hairs. Under surface washed with pale drabby whitish, the bases of the hairs slate. Head uniform with back. Eyes with narrow buffy rims. Ears brown. Hands and feet dull whitish. Tail well-haired, bicolor, blackish brown above, dull whitish below, but the contrast not strongly marked.

Skull of somewhat similar build to that of *A. obscurus*, stout, rather strongly bowed, with broad interorbital region, the edges of which are square but not beaded or ridged. Palatal foramina well open. Posterior nares narrow. Incisors rather more turned back than usual, but there is some variation in this respect, the angle with the tooth-row in one specimen only 66° , while in others it rises to 74° , 75° , 79° , and 80° , a range of variation quite unusual; but the first specimen is probably abnormal.

Dimensions of the type (measured in flesh):—

Head and body 116 mm.; tail 89; hind foot 23 (range from 20); ear 17.

Skull: greatest length 29; condylo-incisive length 27.8; zygomatic breadth 15.2; nasals 10.7; interorbital breadth 5.1; breadth of brain-case 12.2; palatilar length 12.8; palatal foramina 7.2; post-foraminal palate 4.2; upper molar series (worn) 4.8.

Hab. Yacanto, near Villa Dolores, south-western slopes of the Sierra de Cordova. Alt. 900 m.

Type. Old male. B.M. no. 16.1.6.38. Original number 2536. Collected 19th November, 1915, by R. Kemp. Presented by Oldfield Thomas. Five specimens.

This well-marked species looks as if it were allied to *A. obscurus* and *lenguarum*, but its incisors are markedly less thrown outwards. Its skull is perhaps most like that of *A. varius*, from which, however, as from all the others, it is readily distinguishable by its uniform pale brown colour.

Akodon simulator, sp. n.

Allied to *A. varius*, but with the coloration of members of the *longipilis-hirtus* group (genus *Abrothrix* of the succeeding paper).

Size fairly large. Fur long, hairs of back about 9–10 mm. in length. General colour dark greyish, strongly suffused on the back with "clay-colour"; head, shoulders, flanks, and hips slaty or purplish grey. Under surface washed with buffy or drabby whitish, the basal seven-eighths of the hairs dark slaty; chin prominently contrasted white, the hairs

white to their bases. Hands and feet grey. Tail blackish brown above, whitish below.

Skull very like that of *A. varius*; interorbital region not quite so broad, similarly square-edged, without definite ridges. Incisors slightly more slender:

Dimensions of the type:—

Head and body 98 mm.; tail 79; hind foot 24; ear 18.

Skull: greatest length 28·5; condylo-incisive length 27; zygomatic breadth 14·7; nasals 10·2; interorbital breadth 4·6; breadth of brain-case 12·2; palatilar length 12·6; palatal foramina 7; post-foraminal palate 4; upper molar series 4·9.

Hab. Tucuman. Type from Villa Nougés, San Pablo. Alt. 1200 m.

Type. Adult male. B.M. no. 2. 1. 5. 8. Original number 1365. Collected 22nd September, 1901, by L. Dinelli. Presented by Oldfield Thomas. Six specimens.

While this species resembles *A. varius* in the buffy or clay-colour of the dorsal suffusion, it differs by the contrasted grey of the head, shoulders, flanks, and hips, which give it a deceptive resemblance to the species of *Abrothrix*. But there is no doubt that its nearest relationship is with the first-named animal. Its peculiar white chin is unique, but I should not lay very much stress on this character, which may easily prove variable.

XL.—*The Grouping of the South-American Muridæ commonly referred to Akodon.* By OLDFIELD THOMAS.

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IN his 'Mammals of Patagonia' Dr. J. A. Allen has drawn attention to the composite nature of what is usually called *Akodon*, and has indicated one or two groups which he thinks ought to be generically or subgenerically distinguished—for example, those named below *Chalcomys* and *Chræomys*.

I have now had an opportunity to examine the whole group, which I find—uniform as it is in essential characters, and notably in the hypsodontism and general structure of the teeth—may be subdivided into seven genera. Of these, three—*Akodon*, *Abrothrix*, and *Zygodontomys*—were previously provided with names, while four need new ones. Two of these four are inhabitants of the Andean plateau and two of the lowlands of Brazil. A special subgenus is also made for *A. arosus*, *A. urichi*, and their allies.

The following key to the genera may assist in the determination of specimens :—

- A. Supraorbital edges more or less squared.
- a. Claws normal. Bullæ not enlarged.
 - a². Form unmodified; tail of medium length; eyes not reduced.
 - a³. Supraorbital edges square or beaded, but without overhanging ledges.
 - a⁴. Supraorbital edge beaded. *M*¹ without notch on anterior face I. *Zygodontomys*.
 - b⁴. Supraorbital edge not or scarcely beaded. *M*¹ with anterior notch.. II. *Akodon*.
 - a⁵. Fur normal. Colour grey, olivaceous, or pale brown II. A. *Akodon*, s. s.
 - b⁵. Fur velvety. Colour dark brown or coppery II. B. *Chalcomys*.
 - b³. Supraorbital edges with overhanging ledges. *M*¹ with notch..... III. *Thalpomys*.
 - b². Form *Pitymys*-like, with short tail and reduced eyes. *M*¹ with notch IV. *Thaptomys*.
 - b. Claws elongated. Interorbital region broad, with squared edges. Bullæ enlarged. *M*¹ without notch V. *Bolomys*.
- B. Supraorbital edges rounded. *M*¹ without anterior notch.
- a. Snout not elongated. Brightly contrasted markings present. Fore-claws lengthened. Bullæ large VI. *Chracomys*.
 - b. Snout elongated. Coloration normal. Fore-claws not lengthened. Bullæ normal.... VII. *Abrothrix*.

I. ZYGODONTOMYS, Allen.

Form normal. Fur coarse. Colour coarsely lined brown, the lining heavier than in any other members of the group. Claws of normal proportions, the fourth * fore-claw 2·1 mm. in a specimen with hind foot 24 mm., and the fourth hind claw 2·6 mm.

Skull comparatively strongly built, its upper outline evenly bowed. Supraorbital edges square, with well-defined beads running back across the parietals. Zygomatic plate well thrown forward, its front edge often slightly concave. Palatal foramina scarcely or not narrowed behind, and not penetrating so far between the molars as in most of the succeeding genera.

First molar without a deep groove separating the two cusps of the anterior lamina.

* Although the third claw is generally a little longer than the fourth, the two vary together, and there seems no objection to taking the length of the fourth as being by far the most convenient to measure on dried skins, the third being commonly hidden behind the fourth. In measuring the corresponding claw behind, care must be taken to remember the reversed position of the foot in modern skins.

Genotype. *Z. cherriei*, Allen (*Oryzomys cherriei*, Allen).

The recognition of *Zygodontomys* as a genus distinct from *Akodon* is somewhat provisional, and can only be finally settled when specimens with unworn molars of many more species are available for examination. Such species as *Akodon lenguarum* undoubtedly tend to connect the two groups, but without a series of young specimens a definite conclusion is not easy to arrive at.

II. AKODON, Meyen.

Fur generally less coarse than in *Zygodontomys*. Colour variable, the more typical species greyish olivaceous, without special markings. Claws rather variable, the members of the *obscurus* group with rather longer fore-claws than is the case in the others; a specimen of *A. boliviensis* has fourth fore-claw 2.0 mm., hind 2.7, of *A. obscurus* fore 2.7, hind 3.7.

Skull more lightly built than in *Zygodontomys*. Interorbital region fairly narrow, its edges squared more or less sharply, and occasionally with slight beading, but never with overhanging ledges. Palatal foramina usually narrowed behind, penetrating far between the molars. Bullæ comparatively small.

First upper molar with a well-defined groove or valley on its anterior surface between the cusps of the first lamina; this wears out as age advances, but slight traces of it may generally be perceived.

Two subgenera, as follows:—

II. A. AKODON, s. s.

Fur normal. Colour grey, pale brown, or olivaceous.

Skull of normal shape; the brain-case and interorbital region fairly narrow.

Genotype. *Akodon boliviensis*, Meyen.

II. B. CHALCOMYS, subgen. nov.

Fur fine and velvety. Colour dark brown or coppery, the under surface scarcely lighter than the upper.

Skull with large rounded brain-case and broad interorbital region.

Genotype. *Akodon (Chalcomys) ærosus*, Thos.

Other species: *urichi*, All., *venezuelensis*, All., *meridensis*, All.

This subgenus contains the blackish Akodons, which, like *Melanomys* in relation to *Oryzomys*, form a special group in the tropical countries of north-western South America.

Even after the removal of the members of *Chalcomys*, the genus *Akodon* tends to divide into two—the more typical species, light and delicate, with thinly built skulls, and generally of a more uniform olivaceous colour, and those with comparatively heavy skulls, and with their colour more contrasted with blackish lining. The latter group seem to approach *Zygodontomys*, and may prove to intergrade with it.

III. THALPOMYS, gen. nov.

Fur crisp. Colour of only species warm ochraceous or rufous. Fourth fore-claw 2.0 mm., hind 2.2.

Skull and teeth as in *Akodon*, except that there is a distinct overhanging ledge on each edge of the interorbital region. Palatal foramina long, much narrowed behind.

First molar of the only specimen available, although worn, showing clear trace of an anterior groove.

Genotype. *T. lasiotis* (*Mus lasiotis*, Lund; *Habrothrix lasiotis*, Winge).

IV. THAPTOMYS, gen. nov.

General build modified for a subterranean life, very much as in the most marked species of *Pitymys*, the fur short and velvety, the eyes reduced in size, and the tail shortened. Fore and hind claws about equal, the fourth 2.6–2.8 mm. in length.

Skull strongly built; interorbital region very broad, with squared edges. Zygomatic plate scarcely projected forwards. Palatal foramina smallest in the group, narrow, scarcely reaching the level of m^1 . Bullæ small.

First molar with anterior notch.

Genotype. *T. subterraneus* (*Hesperomys subterraneus*, Hens.). (This is probably a synonym of "*Mus nigrita*," Licht., but I use a name about whose identification there can be no doubt.)

A genus distinguished by the modifications due to a more completely subterranean life.

V. BOLOMYS, gen. nov.

Fur normal or rather coarse. Colour strongly lined, with contrasted light underside. Claws elongated, the fore nearly as long as the hind; in *B. albiventer* the fourth may attain 3.3 mm. in front and 3.5 behind.

Skull stout and strongly built, with broad square-edged interorbital region. Zygomatic plate projected forward.

Palatal foramina narrowed behind, continued well between the molars. Bullæ very large.

First molar apparently without anterior notch, but quite young specimens are not available.

Genotype. *B. amœnus* (*Akodon amœnus*, Thos.).

Other species: *B. albiventer*, Thos., *B. berlepschi*, Thos.

By its large bullæ and long claws *Bolomys* resembles *Chœomys*, but the general facies and the structure of the rest of the skull seem to indicate a nearer relationship to *Akodon*.

The three species are all inhabitants of the Andean highlands.

VI. CHRÆOMYS, gen. nov.

Fur long, soft, and fine. Coloration very striking, with contrasted patches of white or ochraceous. Ears large. Claws long, the anterior exceeding the posterior; fourth fore claw in *C. pulcherrimus* 4.0 mm., fourth hind 3.6.

Skull with large rounded brain-case. Interorbital region with its edges smoothly rounded. Zygomatic plate scarcely projected forward. Palatal foramina of medium length. Bullæ very large.

Incisors unusually slender, their front surface a paler yellow than in the other genera. First molars without anterior notch.

Genotype. *C. pulcherrimus* (*Akodon pulcherrimus*, Thos.).

Other species: *C. bacchante*, Thos., *jelskii*, Thos., and probably *scalops*, Gay.

VII. ABROTHRIX, Waterh.

Fur long and soft. Coloration normal—generally slaty grey with a suffusion of buffy in the dorsal area. Claws not elongated.

Skull with rounded brain-case and long muzzle. Interorbital region of medium breadth, its edges smoothly rounded. Bullæ of normal size, not enlarged.

First molar without anterior notch.

Genotype. *A. longipilis*, Waterh.

Other species: *A. hirtus*, Thos., *suffusus*, Thos., *francei*, Thos.

XLI.—*Shell-banding as a Means of Protection.*

By A. E. TRUEMAN, M.Sc., University College, Nottingham.

ALTHOUGH the alternate light and dark bands which characterize many animals may have some value as a protection, yet it must not be supposed that any protective device will ensure complete safety to the species which adopts it. Thus, S. D. Judd* found that large numbers of insects, supposedly protected in various ways, were, nevertheless, detected by birds. W. H. Dall† has suggested that the tendency to striped markings would probably aid in the concealment of snail-shells, although it is well known that many banded snail-shells (*Helix nemoralis*, L.) are broken at thrush "anvils." In this case, however, the value of the banding can be investigated with less difficulty, for a considerable proportion of the shells of this species are unbanded or have few bands. If, then, the banding is of real value in rendering the shells less conspicuous, the proportion of unbanded shells among those captured by birds will be greater than the proportion normally occurring in the same district.

This problem is dealt with in an interesting paper by Rev. E. A. Woodruffe-Peacock‡, who stated that around Brigg the shells occurring most commonly at thrush anvils were unbanded, while shells with one band came next in order, although these varieties were not the most abundant in the neighbourhood. The comparatively complex formulæ which Mr. Woodruffe-Peacock used in his work make his records of great value; the less definite but quicker method of simply counting the bands is, however, adopted here, since it allows of a more convenient comparison of the broken shells and the standard collection.

Both these collections were made from the same locality—a belt of country on the Magnesian Limestone, some 3 miles long, stretching from Wollaton to Strelley, on the west of Nottingham. Since the Mollusca are less abundant in this locality than in Lincolnshire, large anvils such as those described in the paper referred to§ are unknown; consequently, the records here given refer only to some two thousand shells. The standard collection made for comparison consisted of unbleached dead shells found during the

* 'American Naturalist,' xxxiii. 1899, p. 461.

† See J. W. Taylor, Monog. Land and Freshwater Shells of Brit. Is. vol. i. p. 95 (1894).

‡ "Thrush Stones," Naturalist, 1909, pp. 171-174 & 257-259.

§ Loc. cit. p. 171.

winter ; a collector seeking living shells in their natural haunts, since he would be working under conditions somewhat similar to the birds themselves, would probably secure an excessive proportion of unbanded shells. During the winter, however, the relative absence of vegetation makes it easy to see dead shells of all types, and so the standard collection gives a fairly correct representation of their proportions.

Striking confirmation of Mr. Woodruffe-Peacock's observations on the localization of the different varieties was obtained while making this collection ; thus, in the lane near Broxtowe for a distance of 50 yards quite four-fifths of the shells found had one band only.

The complete details of the collections were as follows :—

		Standard Collection.	"Anvil" Collection.
Unbanded	.....	25 per cent.	38 per cent.
1 band	.....	16 "	23 "
2 "	.....	2 "	2 "
3 "	.....	5 "	6 "
4 "	.....	9 "	8 "
5 "	.....	42 "	23 "
6 "	.. less than 1	1 "	..

Thus, although fully two-fifths of the standard collection had the normal five bands, little more than half this proportion of the broken shells were so marked. Further, although unbanded shells constituted only a quarter of the standard collection, they occurred in greater numbers among the broken shells. The chances of an unbanded shell being observed are, according to these figures, about three times as great as of a normal shell. Stated more concisely, in the standard collection there was an average of 2·9 bands per shell ; among the broken shells the average was much lower, viz., 1·9 per shell.

These figures appear to confirm previous work, although the present investigation has been carried out in a different district and in quite a different manner. Certainly it seems clear that banding alone is not a guarantee of safety—as a matter of fact, a reasonably large percentage of banded shells are detected by the birds. Yet the figures appear to show that banded shells are less liable to be seen—or, at least, to be eaten—than unbanded.

In concluding, I should like to express my indebtedness to Prof. J. W. Carr, Prof. H. H. Swinnerton, and the Rev. E. A. Woodruffe-Peacock for the assistance they have given me in carrying out this work.

XLII.—*Notes on Fossorial Hymenoptera*.—XXIV. *On the Genus Nitela, Latr.* . By ROWLAND E. TURNER, F.Z.S., F.E.S.

THE genus *Nitela* consists of very small wasps, which form their nests in dry wood, often in deserted beetle-holes, preying on small Homoptera. The genus has a wide range, occurring in all regions of the Old World and also in the Neotropical region, but apparently is absent from North America. Owing to the small size of the species, the genus is poorly represented in most collections, and doubtless many more remain to be discovered. Of the fifteen species recorded in this paper five are from Africa south of the Equator, two from Europe, one of these extending through India to Ceylon, three from Australia, and five from the Neotropical region.

Genus NITELA, Latr.

1. *Nitela spinolae*, Latr.

Nitela spinolae, Latr. Gen. Crust. & Insect. iv. p. 77 (1809). ♀.

Hab. Europe.

2. *Nitela fallax*, Kohl.

Nitela fallax, Kohl, Verh. zool.-bot. Ges. Wien, xxxiii. p. 343 (1883). ♂ ♀.

Hab. Tyrol (Kohl); Pusa, Bihar (G. R. Dutt); Ceylon (*Thwaites*).

I have not seen European specimens, but from the description I consider there can be no doubt that the Indian specimens belong to the same species. The genus does not appear to have been previously recorded from India.

3. *Nitela sculpturata*, nom. nov.

Nitela reticulata, Turn. Proc. Zool. Soc. London, p. 508, 1908 (October). ♀ (nec *N. reticulata*, Dücke, 1908, March).

Dücke's name has priority by a few months, and must be retained for the Brazilian species.

Hab. Mackay, Queensland.

4. *Nitela kurandæ*, Turn.

Nitela kurandæ, Turn. Proc. Zool. Soc. London, p. 508 (1908). ♀.

Hab. Eastern coast districts of Queensland.

5. *Nitela australiensis*, Schulz.

Nitela australiensis, Schulz, Fauna Südwest Australiens, i. xiii. p. 483 (1908). ♀.

Nitela nigricans, Turn. Trans. Ent. Soc. London, p. 428 (1910). ♀.

Hab. S.W. Australia, Tasmania, Eastern Queensland.

6. *Nitela capicola*, Brauns.

Nitela capicola, Brauns, Verh. zool.-bot. Ges. Wien, lxi. p. 140 (1911). ♂.

I have not seen this species, but from the description it appears to be a form of *N. fallax*, or, at all events, very closely allied to that species.

Hab. Port Elizabeth, South Africa.

7. *Nitela transvaalensis*, Brauns.

Nitela transvaalensis, Brauns, Verh. zool.-bot. Ges. Wien, lxi. p. 141 (1908). ♀.

Hab. Lichtenberg, Transvaal.

8. *Nitela promontorii*, Brauns.

Nitela promontorii, Brauns, Verh. zool.-bot. Ges. Wien, lxi. p. 141 (1911). ♂.

Hab. Uitenhage, S. Africa.

9. *Nitela merceti*, Brauns.

Nitela merceti, Brauns, Verh. zool.-bot. Ges. Wien, lxi. p. 142 (1911). ♀ ♂.

Hab. Willowmore, S. Africa.

10. *Nitela rufiventris*, Turn.

Nitela rufiventris, Turn. Ann. & Mag. Nat. Hist. (8) xvii. p. 448 (1916). ♀.

Hab. Nyasaland.

11. *Nitela reticulata*, Dücke.

Nitela reticulata, Dücke, Rev. d'Entom. xxvii. p. 47 (1908). ♀.

Hab. Parà.

12. *Nitela amazonica*, Dücke.

Nitela amazonica, Dücke, Verh. zool.-bot. Ges. Wien, liii. p. 270 (1903).

Hab. Parà, Minas Geraes.

13. *Nitela schmidtii*, Brauns.

Nitela schmidtii, Brauns, Verh. zool.-bot. Ges. Wien, lxi. p. 142 (1911).
♀.

Hab. Costa Rica.

14. *Nitela costaricensis*, Brauns.

Nitela costaricensis, Brauns, Verh. zool.-bot. Ges. Wien, lxi. p. 143
(1911). ♀.

Hab. Costa Rica.

15. *Nitela darwini*, sp. n.

♀. Nigra; mandibulis, tegulis, femoribus macula apicali, tibiis macula basali, tarsisque articulo basali ferrugineis; alis hyalinis, iridescentibus, venis fusco-ferrugineis.
Long. 3.5 mm.

♀. Head finely and very closely punctured, the clypeus and front as high as the base of the antennæ covered with silver pubescence. Posterior ocelli twice as far from each other as from the eyes. Pronotum short, the anterior and posterior margins distinctly raised, the space between them with distinct longitudinal striæ; the anterior margin feebly arched, not straight. Mesonotum rather more strongly and closely punctured than the head, the scutellum and post-scutellum more finely punctured. Mesopleuræ very finely punctured, the grooves shallow. Median segment coarsely longitudinally striated, the striæ slightly diverging towards the apex; the surface of the apical truncation very finely granulate; the sides of the segment finely rugulose-striate.

Abdomen shining, the two basal segments smooth, the apical segments sparsely punctured.

Hab. Charles Island, Galapagos (*C. Darwin*).

This was taken by Charles Darwin on the voyage of the 'Beagle,' but has remained undescribed. It is much more nearly allied to the two species described by Dr. Brauns from Costa Rica than to those from the lower Amazon. From *N. schmidtii* it differs in the proportionate distance between the posterior ocelli and the eyes, the ocelli being as far from the eyes as from each other in *schmidtii*. From *costaricensis* it differs in the sculpture of the median segment, and from both in details of colour.

XLIII.—*Pisidium supinum*, *A. Schmidt*, and *P. parvulum*, *Clessin*, fossil in Ireland. By B. B. WOODWARD, F.L.S. &c.

IN the 'Irish Naturalist' for July (pp. 101-105), Mr. R. A. Phillips places on record the occurrence of *Pisidium supinum* and *P. parvulum* in some sandy deposits in Ireland. His material, with customary courtesy, he has placed at my disposal for examination, and I have great pleasure in cordially congratulating him and his coadjutor, Mr. A. W. Stelfox, in having added these species to the Irish Molluscan fauna, and, in the latter case, to the British as well.

At the same time some statements in Mr. Phillips's paper and some of the results claimed cannot be passed without challenge.

The pair of valves submitted as *P. parvulum* from the Suir, near Clonmel, and two of the three valves from the Shannon at Plassy, near Limerick, belong undoubtedly to that species. The odd larger valve from the Shannon is manifestly not the same, and through rolling has so completely lost its hinge-characters that it is impossible to place it with any certainty, although not improbably it is a young example of *P. liljeborgii*. Judging from the state of preservation of the shells, living examples may yet be found in these two localities. Of the thirteen valves sent as *P. parvulum* from the Suir, near Fiddown, five are referable to that species, the remainder, judged even by Mr. Phillips's own criteria, are young *P. supinum*. Three out of a score of valves from the Barrow, near New Ross, are also passable as

P. parvulum, the balance, again, being *P. supinum*, although the adult form has not yet been recorded from there*.

None of the specimens from the Pleistocene deposits of the Thames received as *P. parvulum* from either Mr. Phillips or Mr. Stelfox could at all be made to agree with true examples of the species or the diagnoses in the paper. Since stray valves of *P. lilljeborgii* have been found in these deposits, there is no inherent improbability in the occurrence of its northern congener *P. parvulum*; but though the writer has again carefully searched his abundant material, no example can so far be found.

Shells supposed to be living *P. parvulum* from the Grand Junction Canal in Hertfordshire, shown me by Mr. C. Oldham, are merely fry of *P. supinum*.

The characters on which Mr. Phillips relies for differentiating *P. parvulum* from the closely similar young individuals of *P. supinum* cannot altogether be accepted as valid. Thus he says:—"In the left valve the base of the lower cardinal tooth (*c* 2) is not continuous with that of the anterior lateral (*a* II), but runs at an angle across the top of it, and tapers off to near the shell-margin." It is so figured by Mr. Stelfox in the accompanying plate, and when first placed under the microscope and superficially examined, the specimen figured appears to bear out the statement. When, however, it is carefully examined and tested by varying the incidence of the light, this conclusion is dispelled. The true base of the cardinal tooth proves continuous along the edge of the hinge-plate with the lateral, as the well-known morphology of the Pelecypod hinge would postulate, whilst the anterior margin of the tooth it is that tails off partly in the manner, but not wholly in the degree described. Specimens, moreover, in my collection are not wanting in which this margin has also preserved its continuity with the lateral tooth. The same feature is observable to a greater or less degree in other species of the genus in which the cardinal teeth are set more or less at an angle to the hinge-line. This, then, is not a specific character. Nor is the depth of the ligament-pit, which an examination of extensive series shows to vary with the individual and with age; some of my *P. parvulum* have a very well-marked ligament-pit, with a ridge on the ventral side. The degree of application of the dorsal marginal teeth in the right valve to the shell-margin is likewise not a reliable criterion; adult and unmistakable examples of

* Some very thickened forms of *P. casertanum* do occur in the deposit that much resemble *P. supinum*, and may have led to the latter being overlooked.

P. supinum in my collection have these teeth quite as much separated from the shell-margin as shown in Mr. Phillips's figure, and instanced by him as characteristic of *P. parvulum*. It is all a matter of sufficient material on which to base conclusions, and that at present Mr. Phillips and Mr. Stelfox do not seem to possess, and its lack cannot be compensated for by zeal even as great as theirs.

A feature that is of real importance is the character of the cardinal teeth in the left valve. In *P. supinum* the apex of *c* 2 is directed towards the umbo, so that its posterior margin seems to directly traverse the hinge-plate, and, *c* 4 being parallel to it, the effect is given of both teeth lying transversely to the hinge-line. In *P. parvulum*, on the other hand, these two teeth appear as approximately parallel with the shell-margin.

With respect to *P. supinum*, there is no question as to its occurrence in the sands named, but there is just a doubt as to how it got there. The deposit in which this species was first found in Ireland—namely, at Waterford Bridge, by Mr. Phillips—contained a specimen of *Vivipara*, which genus has so far not yet been established as Irish, pieces of flint, which is not a product of southern Ireland, and the apical portion of a *Tiara inquinata*, the well-known fossil characterizing the Woolwich beds, which certainly are altogether unknown in Ireland. Moreover, since the mineralization of the specimens of *P. supinum* and some other shells in the deposit differed from that of the rest and agreed exactly with the state of preservation of the shells in the Thames Holocene sands, the inference was irresistible that they had been introduced in ballast.

Mr. Phillips pleads in correspondence that the Fiddown deposits, being 15 miles higher up the river, where no boats with ballast go, this possibility of introduction is precluded. In view of the facts above recited, however, and remembering that trade with Ireland has been going on for many centuries, during the greater part of which time small sailing vessels would be employed that could proceed higher up stream, the possibility of importation is not lightly to be ignored. Moreover, in the days before half-hundredweights or bars of iron were available with which to trim the boat, and in the absence of rocks from the Thames foreshores, what more likely than that bags filled with river-sand should be employed. In short, stronger proof than is at present adduced should be offered ere the claim that *P. supinum* is indigenous in Ireland can be established.

XLIV.—*Descriptions of New Pyralidæ of the Subfamilies Epipaschianæ, Chrysauginæ, Endotrichinæ, and Pyralinæ.*
By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c.

[Continued from p. 160.]

(3) *Callasopia undulilinea*, sp. n.

Fore wing with vein 3 from well before angle of cell.

♂. Head, thorax, and abdomen white tinged with pale red-brown; palpi with the 3rd joint white at base; fore tarsi rufous ringed with white, the mid tarsi whitish, the hind tarsi white with a rufous band at extremity of 2nd joint. Fore wing whitish suffused and irrorated with red-brown; the medial area with four waved red-brown lines; postmedial line double, red-brown filled in with whitish, oblique to discal fold, then minutely waved; a punctiform red-brown terminal line. Hind wing whitish suffused with reddish brown, a slight dark terminal line. Underside of fore wing reddish brown, the costal area rufous with a postmedial white spot on it; hind wing whitish tinged with brown, the costal area irrorated with rufous, a small rufous spot on upper discocellular and double waved postmedial line filled in with whitish from costa to vein 4.

Hab. PERU, Pozuzo, 1 ♂ type. *Exp.* 16 mm.

(1b) *Uliosoma exciralis*, sp. n.

Fore wing with the costa excised beyond middle.

♀. Head and thorax whitish suffused with brick-red; abdomen dark brown, whitish at base, the ventral surface whitish. Fore wing whitish suffused with purplish red and irrorated with dark brown, especially on antemedial area; a curved white medial line and rather oblique slightly sinuous postmedial line. Hind wing whitish suffused with dark brown and faintly tinged with purplish. Underside white irrorated with dark brown and faintly tinged with red.

Hab. COLOMBIA, Choko, Prov. Condoto (*Spurrell*), 1 ♀ type. *Exp.* 14 mm.

(1c) *Uliosoma umbrilineata*, sp. n.

♀. Head and thorax whitish suffused with purplish pink; abdomen orange-yellow with pale rings; palpi, legs, and ventral surface of abdomen deeper purple-pink, the mid tarsi pure white, black at extremities. Fore wing whitish, suffused with purplish pink; fine erect dark brown ante- and postmedial lines; a slight brown terminal line. Hind wing whitish tinged with purplish pink; a slight brown terminal line. Underside of fore wing pale purplish pink, the costal area irrorated with dark brown to the postmedial line and with slight yellow marks on medial part of

costa, the postmedial line fine, black with a black point at costa, straight and erect, obsolescent towards inner margin, a terminal series of dark striae; hind wing whitish tinged with pink except on inner area, the costal area irrorated with purplish red, a curved reddish postmedial line and terminal series of dark striae.

Hab. PERU, Rio Pacaya, 1 ♀ type. *Exp.* 12 mm.

(1 d) *Uliosoma acutialis*, sp. n.

Hind tibiae slightly fringed with hair, the 1st joint of tarsi without tuft of scales; abdomen of male without lateral tufts of hair; fore wing narrow, the apex produced.

♂. Head and thorax yellow tinged with purplish pink; abdomen white; fore legs white, the tibiae purplish red in front; mid legs white, the tibiae purplish red; hind legs purplish red. Fore wing yellowish, the basal half suffused with purplish pink, the postmedial area tinged with purplish pink, the terminal area purplish pink, narrowing to tornus and with its inner edge slightly incurved below costa; cilia yellowish white, tinged with purplish pink towards apex. Hind wing white. Underside of fore wing yellowish suffused with purplish pink; hind wing white, the costal area suffused with purplish pink.

Hab. W. COLOMBIA, San Antonio (*Palmer*), 1 ♂ type. *Exp.* 18 mm.

(3) *Uliosoma caphysoides*, sp. n.

Hind tibiae slightly fringed with hair, the 1st joint of tarsi without tuft of scales; abdomen of male without lateral tufts of hair; fore wing with veins 3 and 5 from cell.

♂. Head and thorax pale purplish red; abdomen white tinged with red-brown; tarsi whitish; ventral surface of abdomen suffused with purplish red. Fore wing whitish suffused and irrorated with purplish red; straight erect white ante- and postmedial lines; a deeper purplish-red terminal line; cilia pale purplish red at base, white at tips. Hind wing white faintly tinged with purplish red, especially on apical area. Underside of fore wing purplish red; hind wing whitish, the costal area suffused with purplish red.

Hab. PERU, Rio Pacaya, 1 ♂ type. *Exp.* 12 mm.

(3 a) *Caphys dentilinea*, sp. n.

♂. Head and thorax greyish tinged with purplish red; abdomen ochreous white; palpi and legs suffused with reddish brown. Fore wing whitish suffused and slightly irrorated with purplish red; antemedial line white defined on outer side by brown, oblique to submedian fold, then incurved; a black point at middle of costa; postmedial line white defined on inner side by brown and with a black point at costa, erect to discal fold, then excurved and minutely dentate to submedian fold, where it is slightly angled inwards; cilia whitish at tips. Hind wing white faintly tinged with brown; a fine brown line through the cilia from apex to vein 2. Underside of fore wing brown, the costal and

terminal areas yellowish tinged with purplish pink, a black point at middle of costa, the postmedial line rather diffused yellowish defined on inner side by black towards costa; hind wing white, the costal area yellowish thickly irrorated with purple-red, a slight waved subterminal line from costa to vein 2.

♀. Head, thorax, and fore wing more strongly suffused with purple-red.

Hab. COLOMBIA, Minca (*H. H. Smith*), 2 ♂, Sierra del Libano (*H. H. Smith*), 1 ♂, 1 ♀ type. *Exp.* 14-22 mm.

(4 a) *Caphys phæogrammalis*, sp. n.

♂. Head, thorax, and abdomen dull purplish red; tarsi ringed with whitish. Fore wing pale dull purplish red; indistinct, slightly sinuous, dark, erect, ante- and postmedial lines, the latter faintly defined on each side by whitish to discal fold; a terminal series of dark points; cilia purplish pink. Hind wing brown tinged with purplish red, the cilia with a whitish line at base. Underside of fore wing dull purplish red, the costa whitish on postmedial area, the postmedial line ochreous defined on each side by brown and with some brown irroration beyond it; hind wing whitish tinged with brown, the costal area purplish red irrorated with brown except towards base, the termen purplish red except towards tornus, a brown subterminal line defined on outer side by ochreous from costa to vein 5, a dark brown terminal line.

Hab. BR. GUIANA, Bartica (*Parish*), 1 ♂ type. *Exp.* 14 mm.

Genus MEGACAPHYS, nov.

Type, *Caphys titana*, Schaus.

Proboscis fully developed; palpi downcurved, extending about twice the length of head and thickly scaled; frons smoothly scaled; antennæ of female minutely ciliated; tibiæ slightly fringed with hair. Fore wing with the costa and termen evenly curved; vein 3 from angle of cell; 4, 5 strongly stalked; 6 from upper angle; 7, 8, 9, 10 stalked; 11 from cell. Hind wing with vein 2 from close to angle of cell; 3 and 5 from angle, 4 absent; 6, 7 from upper angle; 8 anastomosing with 7.

In key differs from *Adenopteryx* in the fore wing having veins 7, 8, 9, 10 stalked; hind wing with vein 4 absent.

(1 a) *Tetraschistis dentilinealis*, sp. n.

♂. Head and thorax whitish slightly tinged with purplish red; abdomen whitish tinged with brownish ochreous except at base; palpi brownish at tips; legs reddish brown; pectus and ventral surface of abdomen rufous. Fore wing whitish suffused with pale purplish red; antemedial line slight, blackish, oblique to above vein 1, then erect; a black discoidal point and a point above it on costa; postmedial line blackish, oblique towards costa, then dentate, inwardly oblique below vein 4. Hind wing white, the termen faintly tinged with brown. Underside of fore wing

whitish tinged and irrorated with brown except on inner area, a blackish discoidal point with oblique black mark above it from costa, the postmedial line forming a black spot at costa, faint below vein 6, bent outwards at vein 5 and obsolete below vein 2; hind wing whitish, the costal area tinged and irrorated with red-brown, a slightly waved blackish postmedial line from costa to vein 5, excurved below costa.

Hab. COLOMBIA, Choko, Prov. Condoto (*Spurrell*), 1 ♂ type. *Exp.* 24 mm.

(1 b) *Tetraschistis ectopolia*, sp. n.

♂. Head, thorax, and abdomen whitish mixed with red-brown; antennæ ringed with blackish; tibiæ at extremities and the tarsi ringed with black-brown. Fore wing red-brown mixed with whitish, the termen whitish except at apex; a fan of large scales below the cell near base; traces of a waved whitish medial line with a white striga from costa and small dark brown scale-tooth on inner margin; a white subterminal line, oblique to vein 6, then slightly waved, incurved at submedian fold; a punctiform black-brown terminal line; cilia whitish mixed with brown. Hind wing whitish tinged with brown, the terminal area suffused with brown except towards tornus. Underside of fore wing reddish brown, the costal area rufous with a white subterminal bar from costa; hind wing whitish tinged with brown, the costal area rufous, the terminal area suffused with red-brown to vein 3, an obscure dark spot on upper discocellular, a whitish postmedial line defined on each side by brown from costa to vein 5.

Hab. PERU, St. Domingo (*Ockenden*), 1 ♂ type. *Exp.* 24 mm.

(2 a) *Tetraschistis ectrocta*, sp. n.

Fore wing with the costa slightly excised at middle and towards apex.

♀. Head and thorax purplish pink; abdomen whitish suffused with red-brown; antennæ ringed with dark brown; palpi bright red-brown, the 2nd joint at middle and the 3rd joint at base white; legs bright red-brown, the fore tarsi ringed with white, the mid and hind tarsi white ringed with brown. Fore wing bright red-brown with a purplish tinge and slightly irrorated with blackish; a black discoidal point with oblique whitish striga above it from costa; postmedial line faint, whitish with some black scales before and beyond it at costa, oblique to vein 5, then inwardly oblique; a slight whitish spot on costa just before apex; cilia with a fine white line at base followed by a purple-pink line, the tips white. Hind wing whitish suffused with brown, the cilia white faintly tinged with brown and with a brown line near base from apex to submedian fold. Underside of fore wing whitish suffused with red-brown, ante- and postmedial white bars from costa defined on each side by dark brown, a whitish patch on costa towards apex, the termen darker brown slightly indented by creamy white at the veins,

the cilia creamy white with a purplish-red line near base; hind wing whitish tinged with brown, the costal area ochreous white irrorated with red, two black bars from costa near base, a double faint curved dark postmedial line, blackish and filled in with white on costal area, a dark terminal line.

Hab. BRAZIL, Rio Janeiro, 1 ♀ type. *Exp.* 20 mm.

(3) *Pelagis griseolimalis*, sp. n.

Fore wing with vein 9 absent.

♂. Head and thorax bright red-brown; abdomen greyish brown; tarsi whitish except the 1st joint and tuft on hind tarsi, the spurs tipped with white. Fore wing bright red-brown, the terminal area purplish grey; some whitish at base of inner margin; antemedial line whitish, oblique, some whitish suffusion beyond it except on inner area; a blackish discoidal bar; a bright rufous patch on postmedial costal area; postmedial line pale grey with a pure white bar from costa, then excurved; a terminal series of black points; cilia with a red-brown line near base. Hind wing grey-brown, the termen darker; cilia pale with a brown line through them. Underside of fore wing grey-brown, the terminal half of costal area and the terminal area to vein 4 bright rufous, the inner area whitish to the postmedial line; hind wing whitish suffused with brown, the apex rufous, a blackish mark on upper discocellular and curved white postmedial line defined on inner side by brown; cilia white at base.

Hab. PERU, Pozuzo, 1 ♂ type. *Exp.* 20 mm.

(3) *Curicta metaxanthalis*, sp. n.

Fore wing with the termen not excised towards tornus.

♂. Head and thorax chestnut-brown; abdomen ochreous yellow; legs and ventral surface of abdomen whitish suffused with brown; tarsi brown ringed with whitish. Fore wing glossy chestnut-brown with slight dark irroration; faint traces of a brown sub-terminal line, incurved below vein 3; cilia darker except towards tornus. Hind wing ochreous yellow, the apical area tinged with brown, the termen and cilia dark reddish brown. Underside of fore wing grey-brown, the inner area whitish, the costa with some whitish beyond middle; hind wing with the costal area and the terminal area to vein 3 suffused with red-brown.

Hab. N. GUINEA, Ron I. (*Doherty*), 3 ♂ type. *Exp.* 22 mm.

(5) *Curicta peruviansis*, sp. n.

Fore wing with the termen hardly excised below apex, a discoidal fan of scales.

♂. Head and thorax bright chestnut-brown; abdomen red-brown; palpi and fore and mid tibiæ deep chocolate-brown; ventral surface of abdomen chestnut-brown. Fore wing bright chestnut-brown irrorated with yellowish white, the basal area paler except towards costa; antemedial line white defined on outer side

by red-brown, very oblique; the discoidal fan of scales black-brown; postmedial line white, oblique to vein 5, then inwardly oblique; a fine white terminal line. Hind wing pale red-brown, the veins towards termen streaked with fiery red, on vein 2 extending half way to the cell; a slight curved whitish postmedial line from costa to submedian fold; a fine white terminal line; cilia fiery red with a white line at middle and white tips. Underside of fore wing pale red-brown, the costal area bright chestnut-red, the inner area whitish, an obscure blackish discoidal spot, the postmedial line defined on inner side by brown; hind wing bright chestnut-red, a curved very slightly waved white postmedial line defined on inner side by brown.

Hab. PERU, Chanchamayo, 1 ♂ type. *Exp.* 40 mm.

(3) *Murgisca pyrophoralis*, sp. n.

♂. Head and thorax maroon-red; abdomen glossy dark grey-brown; pectus and legs dark grey-brown, the tufts of scales on the mid tibiae and tarsi maroon-red, the tarsi ringed with white. Fore wing maroon-red, the postmedial area brilliant fiery red except at costa and inner margin; the antemedial area suffused with fiery red beyond the vesicle from costa to vein 1; a white striga from middle of costa with some yellow beyond it and a minute white spot in upper part of cell; a small silvery-white spot below end of cell with some yellow beyond it; some yellow beyond upper angle of cell; an oblique silvery-white postmedial spot from costa, then a faint curved greyish line, a white striga from costa well beyond it; cilia yellowish white at tips except towards tornus. Hind wing dark glossy grey-brown. Underside of fore wing grey-brown, the terminal half of costa reddish and yellowish with a yellowish bar from costa to discal fold; hind wing grey-brown, the costal area tinged with red except towards base, a diffused whitish postmedial line from costa to submedian fold.

♀. Fore wing with the fiery red on antemedial area reduced to a spot above vein 1.

Hab. PERU, Charape R., Tاراconas (*Pratt*), 1 ♂, 1 ♀ type. *Exp.* 26 mm.

Genus RHYNCHOTOSALE, nov.

Type, *Tosale filata*, Dogn.

Proboscis fully developed; palpi downcurved, extending about the length of head; antennae of male almost simple; hind tibiae and 1st joint of tarsi with tufts of scales. Fore wing of male with large tympanic vesicle at base, the frenulum flattened, the retinaculum forming a ring; the termen excised towards tornus, the inner margin lobed near base; vein 3 from near angle of cell; 4, 5 from angle; 6 from below upper angle; 7, 8, 9 stalked, 7 from before 9; 10 from angle of cell; 11 from cell; a large patch of androconia on underside. Hind wing with the termen somewhat excurved at middle; veins 3 and 5 from angle of cell,

4 absent; 6, 7 from upper angle; 7 slightly anastomosing with 8; a large patch of androconia on upper side on costal area towards apex.

In key differs from *Steptopalpia* in the termen of fore wing being excised towards tornus, vein 7 from before 9, 10 from cell; the palpi about the length of head.

(7) *Lepidomys fuvilimacealis*, sp. n.

♂. Head and thorax pale purplish red; abdomen brownish ochreous; legs purple-brown, the tarsi ringed with white; ventral surface of abdomen whitish suffused with purple-brown. Fore wing pale purplish red tinged with brown, the terminal area suffused with cupreous red; an almost straight erect reddish-white almost medial line; postmedial line reddish white, slightly excurved from below costa to vein 4 and with a white point at costa; a brownish terminal line; cilia purplish pink. Hind wing white tinged with brown, the terminal area tinged with purple to vein 2; cilia purplish pink with white tips to vein 2, then whitish with a brownish line near base. Underside of fore wing purplish red irrorated with some white scales, the inner area ochreous white, the postmedial line ochreous white, a slight dark discoidal bar; hind wing with the costal and terminal areas suffused with purplish red, a curved whitish postmedial line.

Hab. BOLIVIA, Sara Prov., 2 ♂ type. *Exp.*, ♂ 24, ♀ 26 mm.

(8) *Lepidomys meterythralis*, sp. n.

♀. Head, thorax, and abdomen red-brown, tarsi ringed with whitish. Fore wing purplish red-brown, the terminal half of costa deep red; a faint pale curved line just beyond middle, with oblique pure white bar from costa; a postmedial pure white point on costa; a terminal series of pure white points. Hind wing bright fulvous red. Underside fulvous red; fore wing with the costa brownish with a postmedial white point on it.

Hab. PERU, Iquitos, 1 ♀ type. *Exp.* 16 mm.

Genus THERMOTESIA, nov.

Type, *Nachaba violascens*, Schaus.

Palpi rostriform, downcurved, about three times length of head and moderately fringed with hair above and below; frons with large tuft of hair; antennæ of male ciliated; tibiæ slightly fringed with hair. Fore wing with the apex rounded, the termen evenly curved; vein 2 from angle of cell; 3, 4, 5 stalked; 6, 7 shortly stalked; 8 and 10 shortly stalked, 9 absent; 11 from cell; the male with a groove below costa before middle on upper-side followed by a lobe fringed with large scales below. Hind wing with vein 2 from near angle of cell; 3, 4, 5 from angle; 6, 7 from upper angle, 7 anastomosing with 8.

(4) *Lophopleura rectifascia*, sp. n.

♂. Head and thorax deep maroon-red; abdomen dark reddish

brown; pectus, legs, and ventral surface of abdomen grey-brown. Fore wing deep maroon-red with a slight silvery gloss; an erect chrome-yellow antemedial band, somewhat expanding to costa; the terminal half of costa black-brown; a slight dark postmedial line arising below the costal tuft and strongly excurved beyond upper angle of cell; a fine dark terminal line; cilia dark at tips. Hind wing dark reddish brown with a deep maroon-red triangular patch from lower angle of cell to termen; cilia with a dark line at middle and some whitish at tips. Underside grey-brown; hind wing with curved dark postmedial line.

Hab. PERU, Chaquimayo (*Watkins*), 1 ♂ type. *Exp.* 20 mm.

(2) *Pachypodistes angulata*, sp. n.

Fore wing with the costa slightly excised just beyond middle, but the apex not produced upwards, the termen excised below vein 4 and produced to points at veins 6, 4, 3; veins 4, 5 from cell; 7, 8, 10, 11 stalked, 9 absent; hind wing with the termen excurved at middle and produced to slight points at veins 7, 6, 4, 3.

♂. Head and thorax pale ochreous brown with a faint purplish tinge; abdomen pale ochreous brown irrorated with blackish; palpi and legs red-brown mixed with blackish; ventral surface of abdomen red-brown. Fore wing pale purplish red-brown; a rather diffused red-brown antemedial line, slightly excurved below costa, then very oblique; a black discoidal point; a rather diffused red-brown postmedial line, excurved below costa, then very oblique; cilia deep purple-red at tips. Hind wing ochreous tinged with brown, the terminal area suffused with brown; an oblique diffused dark medial line from vein 6 to submedian fold; cilia with black points at veins 8 to 6, the medial part tinged with purple-red and with blackish line near tips. Underside ochreous tinged with purplish red except on inner areas; fore wing with blackish discoidal point and diffused postmedial line excurved below costa, then oblique to submedian fold; hind wing with black discoidal point and oblique slightly sinuous dark postmedial line from costa to lower angle of cell.

Hab. PERU, St. Gaban, 1 ♂ type. *Exp.* 32 mm.

(3) *Pachypodistes sthenistis*, sp. n.

Fore wing narrow, the costa slightly excised just beyond middle but not produced upwards at apex, the termen very oblique and slightly excised from vein 5 to tornus; vein 3 from angle of cell; 4, 5 stalked; 7, 8, and 10 stalked, 9 absent; 11 from cell; hind wing with the termen slightly excised at discal fold; vein 3 from angle of cell; 4, 5 stalked.

♂. Head and thorax bright red-brown with a purplish tinge; abdomen glossy red-brown, ochreous at extreme base; palpi and legs bright red-brown with slight dark irroration. Fore wing bright red-brown with a faint purplish tinge and irrorated with blackish; faint traces of a diffused curved dark antemedial line and of a postmedial line excurved below costa, then oblique. Hind

wing bright red-brown with a faint purplish tinge and irrorated with blackish, the costa ochreous towards base; faint traces of a curved slightly waved dark postmedial line. Underside ochreous suffused with purplish red-brown and irrorated with black except on inner areas; both wings with diffuse curved dark postmedial line from costa to vein 2.

Hab. VENEZUELA, Esteban Valley, Las Quiguas, 1 ♂ type. *Exp.* 32 mm.

ENDOTRICHINÆ.

(2 a) *Endotricha pyrochroa*, sp. n.

♀. Head, thorax, and abdomen fiery crimson; antennæ tinged with brown except towards base; proboscis white towards base; palpi with the 1st joint white in front; pectus with a fan of silvery-white scales in front; mid tibiæ and tarsi white in front. Fore wing fiery crimson, the basal part of costal area and the medial area slightly tinged with brown, the costa with a series of dark points on it; a slightly waved antemedial brown line; a blackish striga on upper discocellular; postmedial line brown, excurved and minutely waved to submedian fold where it is slightly incurved, then again excurved; the terminal area with slight dark irroration; a terminal series of blackish points; cilia brownish. Hind wing fiery crimson, the basal and costal areas tinged with brown, the inner area whitish; a rather obliquely curved dark medial line; a curved brown postmedial line, slightly waved to submedian fold; the terminal area irrorated with blackish; a terminal series of blackish striæ; cilia dark brown with a crimson line at base. Underside fiery crimson, the costal and terminal areas with some dark irroration; fore wing with a series of minute black spots on costa, a curved slightly waved dark postmedial line; hind wing with dark subterminal line, oblique towards costa, then excurved.

Hab. DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♀ type. *Exp.* 26 mm.

(3 b) *Endotricha chionosema*, sp. n.

♂. Head, thorax, and abdomen crimson-red irrorated with a few dark scales; antennæ brownish; legs dull red suffused with fuscous; ventral surface of abdomen fuscous at base. Fore wing dull crimson-red, the costa fuscous brown with a series of white points on it, the basal half fuscous brown with a leaden gloss from just below costa to inner margin, the hair on which is red; a whitish medial line, obliquely excurved to vein 1, then incurved; the terminal area irrorated with fuscous brown, less thickly on costal half; a slightly waved pale red subterminal line, white at costa and defined on outer side by fuscous, ending on termen at vein 1; cilia pale crimson with a black line near base to vein 1, the tips black at apex, then white to vein 4. Hind wing pale crimson irrorated with blackish; a large patch clothed with white

androconia on costal area from base to near apex, its lower edge rounded; a pale red subterminal line defined on each side by black scales, slightly angled inwards at vein 2; a blackish terminal line; cilia with a black line near base, the tips white to submedian fold. Underside of fore wing greyish fuscous except on costal area to beyond middle and to tornus with a large patch of white androconia on it; hind wing with the costal half suffused with fuscous black from near base to the curved slightly waved blackish subterminal line defined on outer side by whitish except towards costa.

♀. Fore wing brighter crimson-red, the basal area tinged with brown to the pale curved antemedial line, the cilia pure white at tips to near tornus; hind wing tinged with brown and irrorated with blackish except on tornal area, an indistinct oblique pale medial line; underside of fore wing tinged with fuscous to the subterminal line, the inner area whitish except at tornus; hind wing irrorated with blackish, an oblique blackish medial line and a pale oblique slightly waved postmedial line defined on inner side by blackish.

Hab. N. GUINEA, Goodenough I. (*Meek*), 1 ♂, 1 ♀ type. *Exp.*, ♂ 22, ♀ 20 mm.

(6a) *Endotricha melanobasis*, sp. n.

Hind wing of male with large patch of rufous androconia on upperside below medial part of costa.

♂. Head and thorax fuscous black; abdomen pale red with a black band on 3rd segment; antennæ whitish tinged with fuscous; pectus and legs pale red, the fore legs suffused with black in front. Fore wing with the basal area blackish to the curved whitish antemedial line, the medial area whitish, the terminal area pale purplish red irrorated with brown, the medial part of costa with white points with black between them; an indistinct blackish and pale subterminal line, obliquely curved to discal fold, then erect; a black terminal line; cilia pure white to vein 6, then pale red at base with blackish line near base, the tips blackish at middle, then white to tornus. Hind wing with the basal area blackish, an elongate patch of rufous androconia below costa from near base to beyond middle; the medial area pale purplish pink below the patch defined on outer side by the slightly waved white postmedial line; the terminal area pale purplish pink irrorated with fuscous; cilia chequered pinkish and blackish with the tips white to vein 2. Underside pale purplish pink irrorated with fuscous, the basal area of both wings and the area beyond lower angle of cell of fore wing suffused with fuscous; fore wing with series of white points on costa with blackish between them, black discoidal bar, and diffused postmedial line from discal fold to above tornus; hind wing with diffused oblique sinuous black medial and postmedial lines.

Hab. ASSAM, Khásis (*Nissary*), 1 ♂ type. *Exp.* 20 mm.

(8a) *Endotricha thermidora*, sp. n.

♂. Head, thorax, and abdomen fiery rufous, the tips of tegulæ, metathorax, and base of abdomen ochreous. Fore wing fiery rufous sparsely irrorated with black; the costa with a series of yellow points with black-brown between them to beyond middle; a small blackish discoidal spot and traces of an oblique waved yellowish line from lower angle of cell to inner margin; a very slightly curved yellowish subterminal line defined on outer side by blackish; a terminal series of black striæ; the terminal area and base of cilia purplish pink, the latter pale yellow at tips. Hind wing pale purplish pink, the terminal area sparsely irrorated with black; a curved yellow postmedial line from discal fold to inner margin, defined on outer side by black scales and on inner side by blackish towards inner margin; a terminal series of black striæ; cilia pale yellow at tips. Underside of fore wing purplish pink irrorated with blackish, the inner area yellowish, the costa with series of yellow points with blackish between them, the subterminal line curved to discal fold, then slightly waved; hind wing yellow, the costal and terminal areas purplish pink irrorated with blackish, a dark antemedial line oblique to median nervure, a small black spot on upper discocellular, a curved slightly waved yellow postmedial line defined on each side by blackish scales, slightly incurved at discal fold.

♀. Strongly tinged with red-brown; fore wing with indistinct pale antemedial line, oblique to submedian fold, a minute black point at upper angle of cell, cilia with some black scales on outer edge of the pink basal part; hind wing with faint pale line from lower angle of cell to inner margin, a faint pale postmedial line arising at vein 6 and excurved to vein 2, no black striæ on termen but a black line at middle of cilia; underside of both wings purplish red irrorated with blackish; hind wing with indistinct curved dark antemedial line and slightly waved double postmedial line.

Hab. DUTCH N. GUINEA, Snow Mts., Oetakwa R. (*Meek*), 1 ♂ type, Wataikwa R. (*Wollaston*), 1 ♀; BR. N. GUINEA, Humboldt Bay (*Doherty*), 1 ♂. *Exp.*, ♂ 22, ♀ 20 mm.

(8b) *Endotricha encaustalis*, sp. n.

♂. Head, thorax, and abdomen purplish red; pectus whitish behind; mid tibiæ and hind legs whitish tinged with red. Fore wing purplish red irrorated with a few blackish scales; the costa with a series of white points, with some black between them to beyond middle; traces of a double blackish medial line from cell to inner margin, slightly excurved at vein 1; a black discoidal bar; a terminal series of black points; cilia purplish pink at base, yellowish white at tips. Hind wing fiery red, the terminal area purplish red, the costal area to near apex and the inner area whitish; an indistinct oblique blackish postmedial line from vein 6 to 2, then curved and whitish to tornus; a terminal series of black

points between discal and submedian folds and a striga towards tornus; cilia purplish pink at base, yellowish white at tips. Underside purplish red irrorated with blackish, the inner half of hind wing whitish except at termen; fore wing with rather punctiform whitish subterminal line defined on inner side by black scales, curved to discal fold then erect to tornus; hind wing with the postmedial line whitish defined on inner side by red, oblique from costa to vein 2, then curved to tornus.

Hab. DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♂ type. *Exp.* 26 mm.

(9 a) *Endotricha xanthorhodalis*, sp. n.

♂. Head, thorax, and abdomen pale yellowish tinged with purplish red. Fore wing pale yellow tinged and irrorated with purplish red, the basal half of costa redder, the termen more purplish pink; the costa with series of yellowish-white points with some black between them towards base; a rather diffused erect red antemedial line; a red discoidal point; a curved yellowish-white subterminal line; a terminal series of black points; cilia purplish pink at base, pure white at tips. Hind wing pale yellow, the terminal area suffused with purplish pink except at costa, narrowing to tornus; a diffused red medial bar from submedian fold to above inner margin; an indistinct red postmedial line, excurved to vein 2, then oblique to tornus; cilia purplish pink at base, pure white at tips. Underside pale yellow, the costal and terminal areas suffused and irrorated with purplish pink; fore wing with blackish between the points on costa to apex, a slight black discoidal point, the subterminal line slightly waved; hind wing with rather diffused waved red medial line and double curved postmedial line.

Hab. QUEENSLAND, Cedar Bay (*Meek*), 1 ♂ type. *Exp.* 24 mm.

(9 c) *Endotricha lignitalis*, sp. n.

♂. Head, thorax, and abdomen pale brownish red, the last irrorated with black except on basal segment, the 2nd and 3rd segments thickly irrorated; legs irrorated with blackish. Fore wing pale brownish red irrorated with black; the costa with series of whitish points with black between them to end of cell; a slightly curved whitish medial line defined on inner side by rather diffused black; a black discoidal spot; a curved whitish subterminal line defined on each side by black scales, more distinctly defined on outer side by black towards costa; a terminal series of blackish points; cilia with a slight dark line at middle and pure white tips. Hind wing pale brownish red irrorated with blackish except the submedian fold, which is rufous, the cell and costal area to near apex white; a slight dark medial line from cell to above inner margin where it forms a small spot; an obliquely curved whitish postmedial line from discal fold to inner margin near tornus, defined on outer side

by diffused black; cilia with a black line at middle and pure white tips. Underside of fore wing flesh-red irrorated with black, the inner area white, the subterminal line minutely waved, somewhat oblique to vein 6; hind wing whitish, the costal and terminal areas flesh-red irrorated with blackish, a slightly curved pale red medial line, postmedial line whitish defined on each side by blackish scales, oblique and slightly sinuous to vein 2 and ending at tornus.

♀. Abdomen not irrorated with black; hind wing with the medial line blackish and more distinct, the postmedial line oblique from discal fold to tornus; underside of fore wing with the subterminal line bent inwards at discal fold.

Hab. QUEENSLAND, Townsville (*Dodd*), 1 ♂ type; N. AUSTRALIA, Port Darwin (*Dodd*), 1 ♂, 1 ♀. *Exp.* 20 mm.

(9d) *Endotricha occidentalis*, sp. n.

♂. Head and thorax purplish red; abdomen ochreous whitish tinged with pink especially towards extremity and on ventral surface and slightly irrorated with black; fore legs suffused with black. Fore wing purplish red slightly irrorated with black; the costa with series of whitish points; a slight blackish discoidal bar; a faint curved whitish subterminal line defined on inner side by some black scales; a terminal series of black striæ; cilia blackish at middle, the tips white. Hind wing ochreous whitish tinged with purplish red especially on terminal half and irrorated with black; a faint whitish postmedial line, oblique to vein 2, then curved to inner margin near tornus; the termen more thickly irrorated with black and with terminal series of blackish striæ; cilia black at middle, the tips white. Underside purplish red, the inner areas whitish; fore wing with small black discoidal spot, the subterminal line defined on inner side by black and slightly bent inwards to costa; hind wing with rather maculate blackish medial line and rather diffused slightly waved postmedial line defined on outer side by whitish.

Hab. W. AUSTRALIA, Waroona (*Berthoud*), 1 ♂ type. *Exp.* 22 mm.

(9f) *Endotricha murecinalis*, sp. n.

♂. Head, thorax, and abdomen purplish pink, the last irrorated with blackish except towards base. Fore wing purplish pink irrorated with black; the costa with series of whitish points; a whitish medial line, obliquely curved to submedian fold, then erect; a minute black discoidal spot; a curved very slightly waved whitish subterminal line; a terminal series of black striæ. Hind wing purplish pink irrorated with blackish, the cell and costal area to near apex whitish; an oblique white medial line defined on each side by black scales from discal fold to inner margin, to which it is slightly bent inwards; postmedial line white defined on each side by black scales, slightly curved to

submedian fold, then excurved to tornus; a terminal series of black striæ; cilia whitish tinged with pink and with blackish line at middle. Underside of fore wing purplish pink irrorated with black, a black discoidal lunule; subterminal line whitish, defined on inner side by black except towards costa, slightly waved, obliquely curved to discal fold, then oblique to tornus; hind wing with the costal and terminal areas purplish pink, the former irrorated with black, a black discoidal bar with oblique line from it to inner margin, a curved black line from costa to discal fold just beyond the cell, an oblique black line defined on outer side by white and slightly waved from costa beyond middle to tornus.

Hab. DUTCH N. GUINEA, Kapaur (*Doherty*), 1 ♂ type. *Exp.* 20 mm.

(9g) *Endotricha primulina*, sp. n.

♂. Head, thorax, and abdomen pale yellow; palpi with the 3rd joint blackish, white at tips; maxillary palpi blackish; pectus, legs, and ventral surface of abdomen ochreous white, the fore tibiae suffused with brown in front. Fore wing pale yellow, the costal area tinged with pink, the terminal area suffused with pink; a postmedial white mark on costa, with a faint curved pinkish line from it to inner margin; cilia black-brown at base, pure white at tips. Hind wing pale yellow slightly tinged with pinkish, the terminal area suffused with pink; a slight dark discoidal spot; a faint pinkish postmedial line; cilia black at base, pure white at tips. Underside pale ochreous; fore wing with the costal and terminal areas suffused with red, a curved red postmedial line; hind wing with reddish discoidal point and oblique postmedial line, the termen tinged with red.

Hab. CAMEROONS, Ja R., Bitje (*Bates*), 1 ♂ type. *Exp.* 12 mm.

(9k) *Endotricha sareochroa*, sp. n.

♂. Head and thorax dull rufous slightly irrorated with darker scales; abdomen brighter rufous, the medial segments strongly irrorated with black; pectus, legs, and ventral surface of abdomen irrorated with black. Fore wing dull rufous with an ochreous tinge and irrorated with blackish; the costa with a series of whitish points with some blackish between them; a whitish antemedial line with a black shade before it from cell to inner margin, slightly angled outwards at median nervure and vein 1; a blackish discoidal striga; subterminal line faint, pale defined on each side by some blackish scales, slightly sinuous; a terminal series of blackish points; cilia with a blackish line near base. Hind wing pale rufous to beyond middle, the terminal area whitish tinged with rufous and slightly irrorated with dark scales; a dark brown terminal line; cilia with a series of dark brown points from apex to submedian fold. Underside white tinged with rufous; fore wing with the costa rufous with series

of white points on it, a slightly waved rufous subterminal line from costa to vein 2; hind wing with the costal area irrorated with blackish, a diffused waved brown postmedial line.

♀. Fore wing with the basal area suffused with brown, the rest of wing rufous; hind wing pale rufous; the underside with the lines faint.

Hab. W. AUSTRALIA, Sherlock R. (*Clements*), 2 ♂, 1 ♀ type. *Exp.* 20–22 mm.

(10a) *Endotricha pulveralis*, sp. n.

♀. Head, thorax, and abdomen pale red-brown irrorated with black-brown; antennæ ringed with blackish. Fore wing pale red-brown thickly irrorated with black-brown; a faint rather diffused dark antemedial line; a blackish discoidal spot; a faint diffused curved dark subterminal line with slight whitish points on it; a terminal series of black points. Hind wing whitish tinged with brown and irrorated with dark brown; a slight blackish discoidal point; a terminal series of blackish points. Underside of fore wing greyish suffused and irrorated with red-brown, the costa with series of dark points; hind wing white tinged and irrorated with brown, a minute black spot at upper angle of cell, a very faint double sinuous brown postmedial line.

Hab. BONIN Is., Parry's Group (*Holst*), 1 ♀ type. *Exp.* 30 mm.

(14a) *Endotricha formosensis*, sp. n.

♂. Head, thorax, and abdomen fuscous with a reddish tinge, the anal tuft purplish red; antennæ whitish tinged with fuscous; legs whitish suffused with brown. Fore wing purplish red, the basal area strongly suffused with fuscous, the rest of wing tinged and irrorated with fuscous; antemedial line white, curved, a series of white points with black between them beyond it on costa; a blackish discoidal bar; subterminal line whitish defined on both sides by black, slightly waved, obliquely curved to discal fold, then erect to tornus; a terminal series of black stræ; cilia pale yellow, purplish pink at base at middle and tornus and with series of blackish spots from discal fold to tornus, the tips blackish at middle. Hind wing purplish pink, suffused with fuscous to beyond the postmedial line then slightly irrorated with fuscous, the costal area whitish to beyond middle; oblique slightly waved white medial and postmedial lines converging towards inner margin; a terminal series of blackish bars; cilia pale yellow, purplish pink at base and with dark line at middle to vein 2, then with series of pink and dark spots. Underside purplish pink; fore wing irrorated with black, the inner area white except at tornus, the costa with series of white points with black between them, a black discoidal spot, the subterminal line black defined on outer side by whitish, waved, obliquely curved to discal fold then erect to tornus; hind wing with the area below discal fold white to the postmedial line, an oblique sinuous black medial line and waved postmedial line defined on outer side by black.

♀. Head, thorax, and abdomen purplish pink, the last tinged with fuscous except at base; fore wing with the basal area slightly tinged with fuscous, the antemedial line diffused on outer side, the subterminal line more bent inwards at discal fold.

Hab. FORMOSA, Arizan (*Wileman*), 1 ♂, 2 ♀ type. *Exp.* 20-22 mm.

(21 a) *Endotricha metacuralis*, sp. n.

♀. Head, thorax, and abdomen pale purplish pink; pectus, legs, and ventral surface of abdomen brown mixed with whitish. Fore wing pale purplish pink slightly irrorated with whitish; a series of white points on costa with dark brown between them; a yellow medial band, its inner edge curved, its outer diffused; a slight black discoidal lunule; subterminal line white defined on each side by brown, slightly waved and somewhat incurved at discal fold; a black terminal line; cilia pale yellow, reddish brown at apex and middle. Hind wing pale purplish pink thickly irrorated with fuscous; a broad yellowish-white medial band narrowing to inner margin, its edges slightly waved and defined by fuscous; a black terminal line; cilia pale yellow with a dark brown line near base from apex to vein 2. Underside of fore wing purplish pink irrorated with fuscous, a diffused black discoidal spot, the subterminal line bent inwards at discal fold; hind wing with the basal area and medial band white except at costa, the latter defined by black which on outer side is defined by a fine white line and angled outwards at discal fold.

Hab. FORMOSA, Rantaizan (*Wileman*), 3 ♀ type. *Exp.* 24 mm.

(21 b) *Endotricha pyrrhæma*, sp. n.

♂. Head, thorax, and abdomen ochreous yellow tinged with red, the anal tuft crimson; palpi, pectus, legs, and ventral surface of abdomen yellowish tinged with red-brown. Fore wing fiery crimson; the costa with a series of white points with dark brown between them except towards base; a sinuous red antemedial line with a diffused yellow band beyond it except towards costa; a slight dark discoidal striga; a yellow patch on costal area before the subterminal line which is slight, whitish defined on outer side by black scales and very slightly waved; a terminal series of black points; cilia dark brown at apex, a series of blackish points at middle to vein 3 and the tips white to vein 3. Hind wing fiery crimson; a broad yellow medial band, its outer edge slightly waved; the costal area white to near apex; the terminal area slightly irrorated with fuscous; a terminal series of black points; cilia paler and with some dark scales at tips. Underside of fore wing fiery crimson irrorated with blackish, the inner area whitish to near tornus, a small black discoidal spot with some yellow above it, the yellow before the subterminal line extending to vein 3; hind wing fiery crimson, the basal area with some yellow except towards costa, the yellow medial band defined by slightly waved crimson lines, on outer side with a yellow line beyond it.

Hab. AMBOINA (*Doherty*), 1 ♂ type. *Exp.* 16 mm.

(22 a) *Endotricha paliolata*, sp. n.

♂. Head and thorax fuscous black, the tegulæ with long scales forming a hood over the thorax and with tuft of long white hair below them from prothorax; abdomen with the three basal segments black and crimson-red, the rest yellow; palpi, pectus, and legs black-brown with a cupreous tinge; ventral surface of abdomen whitish tinged with brown. Fore wing fuscous black with some crimson scales mixed; a curved black antemedial line with a band beyond it which is yellow becoming yellowish white towards inner margin; a yellow patch on costal area before the subterminal line, which is crimson defined on outer side by black, very slightly waved, curved to discal fold, then erect to tornus; the apex crimson; a black terminal line; cilia fiery crimson, yellow towards apex. Hind wing fuscous black with a slight crimson tinge; the inner margin dull crimson towards base; a broad yellowish medial band edged by white and defined by slightly waved black lines; the terminal area crimson towards tornus; a black terminal line from apex to vein 2; cilia crimson to submedian fold, then white and the hair on inner margin white. Underside of fore wing fuscous mixed with crimson, the inner area white, a series of yellow points on costa with black between them, the subterminal line bent inwards at discal fold, then waved; hind wing fuscous black mixed with crimson, a broad oblique white medial band edged by slightly waved black lines, the line on outer side defined by a fine white line.

Hab. LOUISIADÉS, St. Aignan (*Meek*), 1 ♂ type. *Exp.* 18 mm.

(22 b) *Endotricha borneoensis*, sp. n.

♂. Head, thorax, and abdomen pale purplish pink; tufts of long brownish-white hair arising from below the patagia; antennæ brown. Fore wing pale purplish pink slightly irrorated with brown; a broad yellow medial band defined on inner side by a slight dark antemedial line and with a slight black discoidal lunule on its outer edge; a faint pale subterminal line slightly defined on each side by brown, obliquely curved to discal fold, then erect and minutely waved to tornus; a terminal series of black points. Hind wing with the basal area pale purplish pink irrorated with brown, the rest of wing yellow with a few black scales; the apex purplish pink with a blackish striga before it from costa and two black points on termen towards apex. Underside of fore wing pale purplish pink irrorated with blackish, the costa with series of whitish points with blackish between them, a black discoidal bar; hind wing with the basal area pale purplish pink, the rest of wing yellow with the apex pink with some dark striae on it; a slight black discoidal lunule.

Hab. BORNEO, Sarawak (*Wallace*), 1 ♂ type. *Exp.* 16 mm.

(22 b) *Endotricha rhodomicta*, sp. n.

♂. Head, thorax, and abdomen purplish pink mixed with dark brown, the patagia extending to far beyond the metathorax,

black-brown above towards extremity and with tufts of long brownish hair below them; anal tuft with yellowish mixed; antennæ brownish. Fore wing purplish pink mixed with brown; antemedial line brown, excurved to submedian fold, a patch of yellow tinged with red beyond it on costal area conjoined to a broad pale yellow band from cell to inner margin; the terminal half of costa with a series of whitish points with blackish between them; a minutely waved yellow subterminal line defined on each side by brown; a terminal series of black striæ; cilia yellow. Hind wing with the basal area purplish pink mixed with brown, the costal area and inner margin yellowish white, the rest of wing pale yellow, a pale rufous line with some crimson scales on it from costa beyond middle to termen at vein 1. Underside of fore wing with the basal area fuscous brown, the rest of wing purplish pink irrorated with brown, the inner area yellow, the costa with series of yellow points with black between them, a slight black discoidal lunule, the subterminal line bent inwards at discal fold; hind wing yellow, the basal area irrorated with brown and crimson except towards inner margin, the medial part of costa irrorated with crimson, a slightly waved black medial line from costa to submedian fold and two slightly waved crimson postmedial lines, the inner ending on termen at vein 1, the outer before termen at vein 3.

♀. Head, thorax, abdomen, and wings with the purplish pink brighter.

Hab. DUTCH N. GUINEA, Mt. Goliath (*Meek*), 1 ♂, 1 ♀; BR. N. GUINEA, Biagi, Mambare (*Meek*), 1 ♂ type. *Exp.* 20-24 mm.

(31 a) *Endotricha pulchella*, sp. n.

♀. Head and thorax white mixed with dark brown; abdomen white, the medial segments fulvous red ringed with white; antennæ white; palpi fuscous brown with some white at base and towards tips; pectus, legs, and ventral surface of abdomen white. Fore wing white, the area from before middle to the postmedial line suffused with fulvous orange except towards costa, the apical area with a large rather diffused fulvous-orange patch extending to discal fold and with a rufous tinge below it; an indistinct rufous antemedial line, interrupted in the cell; a rufous discoidal bar; postmedial line rufous, excurved at middle; three rather diffused conjoined dark brown spots on apical half of termen, the apical spot defined on inner side by white; cilia tinged with rufous except towards tornus. Hind wing white, the medial area fulvous orange except towards costa, irrorated with red-brown towards inner margin, the terminal area tinged with rufous except at costa, deep rufous towards tornus; a dark brown discoidal spot; a strongly curved deep red-brown postmedial line, curving along the inner margin then up to vein 1 before middle; the cilia with a dark brown line towards tornus and the hair on inner margin with dark brown mixed beyond middle. Underside white; fore wings with brown discoidal striga and both wings with curved postmedial line.

Hab. FORMOSA, Kanshirei (*Wileman*), 1 ♀ type. *Exp.* 18 mm.

(34) *Endotricha pyralodes*, sp. n.

Antennæ of male laminate; the patagia short.

Head and thorax rufous suffused with red-brown; antennæ fulvous; abdomen fulvous; legs rufous irrorated with brown, the tarsi brown with slight pale rings. Fore wing rufous irrorated and in parts suffused with dark brown; an indistinct obliquely curved dark medial line and indistinct curved postmedial line, the area between them and beyond them at costa somewhat paler; a terminal series of blackish points and whitish line at base of cilia. Hind wing fulvous yellow, the costal area from before middle and the terminal area pale thickly irrorated and suffused with fuscous brown; cilia whitish at base, blackish at tips. Underside of fore wing yellowish suffused and irrorated with fuscous; hind wing fulvous yellow, the costal area suffused and irrorated with fuscous, the terminal area irrorated with fuscous, a small black discoidal spot.

Hab. GOLD COAST, Bibianaha (*Spurrell*), 1 ♂, 1 ♀ type. *Exp.*, ♂ 20, ♀ 28 mm.

(3) *Orthoraphis striatalis*, sp. n.

Head and thorax white slightly mixed with red-brown; antennæ ringed with brown; palpi dark brown, the 2nd and 3rd joints white at tips; maxillary palpi dark brown, white at tips. Fore wing creamy white thickly striated with red-brown, the terminal area suffused with red-brown, the costal edge blackish towards base; antemedial line blackish defined on inner side by white, angled inwards at median nervure and outwards at submedian fold; a black discoidal point and three points on postmedial part of costa; subterminal line white defined on inner side by black, angled outwards at discal fold; cilia creamy white at base except towards apex. Hind wing creamy white, the terminal area tinged with red-brown except towards tornus; a brownish shade from costa to beyond lower angle of cell and dark postmedial bar on inner area. Underside of fore wing red-brown irrorated with ochreous white, three black spots on postmedial part of costa with whitish between them, the subterminal line indistinct; hind wing white, the costal and terminal areas irrorated with red-brown, a blackish discoidal spot and obliquely curved postmedial line from costa to vein 1, faint between vein 4 and submedian fold.

Hab. COLOMBIA, Sierra del Libane (*H. H. Smith*), 5 ♂, 1 ♀. *Exp.* 20-24 mm.

Genus GONIOPHYSETIS, nov.

Type, *G. lactealis*.

Proboscis fully developed; palpi porrect, extending about the length of head and thickly scaled; maxillary palpi triangularly scaled; frons smooth; antennæ of male annulate and somewhat laminate. Fore wing with the apex somewhat produced, the termen slightly excised below apex and strongly excurved at

middle, the cilia dentate; veins 3 and 5 from close to angle of cell; 6 from just below upper angle; 7, 8, 9 stalked; 10, 11 from cell. Hind wing with the termen somewhat excised below apex and excurved at middle, the cilia dentate; vein 3 from before angle of cell; 5 from above angle; 6, 7 from upper angle; 7 anastomosing strongly with 8.

Goniophyetis lactealis, sp. n.

♂. Head, thorax, and abdomen white, the last slightly tinged with red-brown before extremity; palpi and maxillary palpi black. Fore wing white, slightly irrorated with rufous, more strongly at middle of terminal area; a fine blackish almost medial and slightly sinuous line, excurved from below costa to submedian fold; a discoidal lunule faintly defined by brown scales; post-medial line blackish, oblique towards costa, excurved at middle, then inwardly oblique, a bright rufous shade beyond it between veins 7 and 4; a black terminal line and two fine brown lines at base of cilia. Hind wing white tinged and irrorated with rufous except on basal and costal areas; a curved blackish antemedial line; postmedial line blackish, curved, with small black spot on it below vein 2; a black terminal line, stronger at discal fold and fine brown line near base of cilia. Underside white with the markings slight; hind wing with black discoidal point and some bright rufous on the postmedial line towards costa.

♀. Palpi and maxillary palpi white; fore wing with much stronger fiery-red shade beyond the postmedial line from costa to vein 4.

Hab. BR. E. AFRICA, Nairobi (*Anderson*), 1 ♂, 1 ♀ type. *Exp.*, ♂ 26, ♀ 30 mm.

(2) *Ischnoscopa chalcistis*, sp. n.

♂. Head, thorax, and abdomen dark brown with a leaden-grey gloss. Fore wing dark brown with a golden-bronze gloss; a curved pale brassy antemedial band and a similar postmedial band incurved below vein 4. Hind wing yellowish white tinged with brown; cilia brown with a leaden gloss. Underside of fore wing pale glossy brown with an oblique postmedial whitish bar from costa; hind wing yellowish white tinged with brown.

Hab. PHILIPPINES, Negros (*Whitehead*), 2 ♂ type. *Exp.* 12 mm.

(1 b) *Hendecasis apicefulva*, sp. n.

♀. White; palpi and maxillary palpi black at tips. Fore wing with black point on vein 1 near base; antemedial black points on subcostal nervure and in submedian fold; a double pale ochreous-brown postmedial line, oblique and slightly curved to vein 1, then bent inwards to inner margin; the costal area tinged with fulvous yellow towards apex; the apical part of termen fulvous yellow narrowing to a point at vein 4 and defined on inner side by a curved black line. Hind wing with double curved antemedial line, the inner line ochreous brown, the outer black; an indistinct

double ochreous-brown postmedial line, rather oblique to vein 1, then bent inwards to inner margin where there is a black point on the inner line; the terminal area faintly tinged with ochreous brown; a black bar on termen in submedian interspace; cilia ochreous brown. Underside of fore wing with minute discoidal lunule faintly defined by blackish, a double ochreous-brown subterminal line, oblique to vein 4, then curved to inner margin; hind wing with double curved ochreous-brown subterminal line with black points on the inner line at costa, discal fold, and inner margin.

Hab. BR. E. AFRICA, Kikuyu Escarpment (*Doherty*), 1 ♀ type.
Exp. 12 mm.

(4) *Hendecasis fulviplaga*, sp. n.

♂. Head, thorax, and abdomen white tinged with ochreous; antennæ with slight brownish rings; tarsi brown ringed with white. Fore wing white slightly tinged with ochreous especially on basal area and irrorated with some blackish scales; a subbasal and two antemedial curved fulvous-yellow lines with some black scales on them; a slight blackish discoidal point; postmedial line fulvous yellow with some black scales on it, excurved below costa, then oblique and sinuous, an oblique fulvous patch irrorated with black scales beyond it from costa to discal fold; a faint diffused fulvous patch on costal area before apex and another before middle of termen; a very narrow terminal pale fulvous-yellow band defined on inner side by some black scales and by an incurved line towards apex; cilia tinged with yellow, the tips black at apex and above middle. Hind wing white; an indistinct double curved fulvous-yellow antemedial line with some black scales on it from cell to inner margin; two fulvous-yellow postmedial lines with some black scales on them, the inner line with black points on it below vein 2 and at inner margin; the terminal area slightly tinged with ochreous; a fulvous-yellow terminal line with some black scales on it. Underside white tinged with ochreous and slightly irrorated with blackish.

Hab. BR. E. AFRICA, Kikuyu Escarpment (*Doherty*), 1 ♂ type.
Exp. 16 mm.

Genus NOORDODES, nov.

Type, *N. purpureoflava*.

Proboscis fully developed; palpi downcurved, extending about twice the length of head and fringed with hair above and below; maxillary palpi triangularly scaled; frons obliquely scaled; antennæ of male ciliated; tibiæ with the outer spurs about one-third length of inner. Fore wing with vein 3 from close to angle of cell; 4, 5 approximated for a short distance; 7 shortly stalked with 8, 9, 10; 11 from cell. Hind wing with vein 3 from close to angle of cell; 4, 5 approximated for a short distance; 6, 7 from upper angle, 7 anastomosing with 8.

Noordodes purpureoflava, sp. n.

♂. Head and thorax yellow, the shoulders, pro- and metathorax

purplish red, the patagia tinged with purplish red at tips; antennæ ringed with purplish red; palpi and maxillary palpi deep purplish red, the former silvery white below towards base; throat and coxæ silvery white; fore tibiae with deep purplish-red band and silvery-white extremity; abdomen yellow, dorsally suffused with purplish red except at base. Fore wing chrome-yellow, the costal area, a subbasal patch on inner area, a larger medial patch on inner area, small discoidal spot, and the terminal area purplish red slightly glossed with silvery blue, the last intersected by an oblique yellow fascia to termen between veins 4 and 2; cilia yellow slightly tinged with red. Hind wing chrome-yellow, the costal area and submedian fold semihyaline white; a wedge-shaped purplish-red patch below and beyond lower end of cell and a patch beyond it on termen with slightly waved inner edge. Underside yellow; fore wing with large semicircular apical purplish-red patch extending to just below vein 4.

Hab. DUTCH N. GUINEA, Mimika R. (*Wollaston*), 1 ♂ type. *Exp.* 26 mm.

(5) *Cotachena fuscimarginalis*, sp. n.

♀. Head and thorax orange; palpi with the 2nd joint streaked with black above and below; pectus and legs whitish, the fore legs streaked with fuscous; abdomen orange, whitish below. Fore wing orange; the costa fuscous connected with two small spots in base of cell, a quadrate spot in middle of cell with slight oblique line from it to vein 1 and a narrow black discoidal lunule; postmedial line black defined by yellow on outer side towards costa, then fuscous, very slightly angled outwards just below costa, then incurved, strongly bent outwards between veins 5 and 2, retracted to near base of vein 2, then slightly sinuous to inner margin; the termen narrowly fuscous with a series of slight yellow striæ on it; cilia with fine black line at base and yellowish tips. Hind wing orange; a minute dark discoidal lunule; postmedial line slightly bent outwards between veins 5 and 2, then retracted to below end of cell and oblique to inner margin; the termen narrowly fuscous with somewhat diffused and slightly waved inner edge; cilia yellow with a black line near base.

Hab. NEW GUINEA, Milne Bay (*Meek*), 2 ♀ type. *Exp.* 24 mm.

PYRALINÆ.

(1f) *Aglossa fumifusalis*, sp. n.

♀. Head and thorax dull rufous; abdomen whitish tinged with rufous and irrorated with blackish; antennæ tinged with fuscous; palpi and legs irrorated with black, the tarsi blackish ringed with white. Fore wing pale rufous; an indistinct waved blackish antemedial line; the medial part of costa with some small blackish spots on it; a small blackish discoidal spot; some fuscous suffusion before the slightly waved blackish postmedial line which is excurved to submedian fold, then incurved; a terminal series of

black bars. Hind wing whitish suffused with pale rufous and irrorated with fuscous; a curved whitish postmedial line defined on inner side by diffused blackish and on outer by a slight fuscous shade; a terminal series of black bars. Underside whitish suffused with rufous and irrorated with fuscous; fore wing with small black discoidal spot, and both wings with curved blackish postmedial line.

Hab. BR. E. AFRICA, Uganda Ry., Kibwezi (Neave), 1 ♀ type. *Exp.* 24 mm.

(5 a) *Aglossa thermochroa*, n. n.

Aglossa rubralis, Hmps. A. M. N. H. (7) xvii. p. 220 (1906), nec Hmps. 1900.

(3) *Paraglossa fumicilialis*, sp. n.

Head, thorax, and abdomen fiery rufous; palpi, pectus, legs, and ventral surface of abdomen paler rufous. Fore wing fiery red; a curved yellow postmedial line with three slight black marks near its origin on costa; a blackish terminal line; cilia blackish with a leaden gloss and a fine whitish line at base. Hind wing fiery red, the terminal area irrorated with fuscous; an indistinct curved yellowish line just beyond middle; cilia blackish with a leaden gloss and a fine whitish line at base. Underside ochreous tinged with red and irrorated with blackish; both wings with curved yellowish postmedial line defined on inner side by diffused blackish.

Hab. CAMEROONS, Ja R., Bitje (Bates), 5 ♂, 1 ♀ type. *Exp.* 22-24 mm.

(4) *Paraglossa sanguimarginalis*, sp. n.

♂. Head, thorax, and abdomen brownish ochreous. Fore wing brownish ochreous, the costal and terminal areas suffused with purplish red; some blackish points on medial part of costa and a small blackish discoidal spot; an indistinct curved ochreous postmedial line faintly defined on inner side by red and ending on inner margin near tornus; a fine whitish line at base of cilia. Hind wing brownish ochreous tinged with purplish red and irrorated with a few brown scales, the terminal area strongly suffused with purplish red; a curved ochreous postmedial line defined on inner side by red; cilia with a purplish-red line at middle. Underside ochreous suffused with purplish red and irrorated with brown except on terminal areas; fore wing with series of small black spots on costa to end of cell and small discoidal spot; both wings with pale curved postmedial band defined on inner side by diffused brown.

Hab. CAMEROONS, Ja R., Bitje (Bates), 3 ♂ type. *Exp.* 18-22 mm.

(1 b) *Hypospygia polycyclophora*, sp. n.

Hind wing with veins 3 and 5 stalked, 4 absent.

♂. Head, thorax, and abdomen white mixed with purplish pink and irrorated with black; pectus and legs whitish suffused with purplish pink. Fore wing whitish mixed with purplish pink

and irrorated with black; the basal area more suffused with black, its outer edge curved and angled inwards at vein 1; a round medial whitish spot defined by black scales above middle of inner margin and similar spots above and below the angles of cell and beyond the cell between veins 5 and 3; a blackish subterminal line arising at vein 6, excurved to vein 3, then incurved, a whitish spot beyond it below the costa; cilia with a series of slight black spots at middle. Hind wing whitish mixed with purplish pink and irrorated with black; a round whitish spot defined by blackish on vein 2 just beyond the cell and a similar smaller spot on vein 3 before the slightly-waved whitish subterminal line somewhat incurved above vein 1; cilia with a series of small black spots at middle. Underside whitish suffused with purplish pink and slightly irrorated with black; both wings with whitish subterminal line defined by blackish as above.

Hab. BR. C. AFRICA, Mt. Mlanje (*Neave*), 1 ♂ type. *Exp.* 16 mm.

(1 c) *Hypsopygia apicalis*, sp. n.

Hind wing with vein 3 stalked with 4, 5.

Head and thorax pale olive-green; abdomen ochreous; antennæ ochreous tinged with brown; legs and ventral surface of abdomen ochreous mixed with dark brown, the tarsi blackish ringed with ochreous. Fore wing pale olive-green, the costal area tinged with rufous and irrorated with dark brown; a faint whitish medial line, incurved below submedian fold; a black point at upper angle of cell; the apical area cupreous red irrorated with dark brown, extending to vein 4 and defined on inner side by a curved white line; cilia whitish at base and pale red at tips to vein 4. Hind wing grey suffused with brown, the cilia whitish tinged with red-brown. Underside of fore wing fuscous black, the costa tinged with rufous, the inner area whitish; hind wing grey suffused with fuscous.

Hab. GOLD COAST, Bibianaha (*Spurrell*), 4 ♂, 5 ♀ type. *Exp.* 16-20 mm.

(2 a) *Pyralis galactalis*, sp. n.

Pyralis ocellalis, Hmps. Trans. Ent. Soc. 1896, p. 509 (nec Led.).

Hind wing with veins 3 and 5 stalked, 4 absent.

♂. Head and thorax red-brown suffused with fuscous; abdomen ochreous, the basal segment with purple-brown patch, the 2nd tinged with fiery red, the others with subdorsal series of purple-brown patches; frons, palpi, legs, and ventral surface of abdomen ochreous suffused with red. Fore wing with the basal area purple-brown suffused with fuscous, the medial area creamy ochreous tinged with rufous towards the postmedial line, the terminal area ochreous suffused with purplish red; the outer edge of the dark basal area sinuous; the medial part of costa with alternating pale rufous and whitish spots; a round whitish spot with pale rufous annulus at upper angle of cell and others below and beyond

lower angle of cell and on vein 1; postmedial line white defined on each side by red-brown, excurved to vein 2, then incurved. Hind wing creamy ochreous tinged with rufous especially on basal area; a blackish-brown patch above basal half of inner margin, with a white bar at its extremity; a curved very slightly waved white postmedial line defined on each side by dark brown and by black on outer side at tornus; a fine rufous line near base of cilia. Underside ochreous white; fore wing with the costal and terminal areas tinged and irrorated with red, the costa with series of white points with dark brown between them to the postmedial line, which is defined on outer side by red-brown; hind wing with the costal area tinged and irrorated with red, the postmedial line as above but less distinct.

Hab. BR. E. AFRICA (*Gregory*), 1 ♂, Machakos (*Crawshay*), 1 ♂; MASHONALAND, Salisbury (*Marshall*), 1 ♂ type; ADEN, Haithalhim (*Yerbury*), 1 ♂. *Exp.* 14-18 mm.

[To be continued.]

XLV.—A new Species of the Crustacean Genus *Squilla* from West Africa. By W. T. CALMAN, D.Sc.

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Squilla africana, sp. n.

Squilla empusa (part.), Miers, Ann. & Mag. Nat. Hist. (5) v. 1880, p. 23.

Squilla empusa, Jurich, Die Stomatopoden d. deutschen Tiefsee-Expedition. Wiss. Ergeb. d. d. Tiefsee-Exp. 'Valdivia,' vii. 1904, p. 366, pl. xxv. fig. 3.

Non *Squilla empusa*, Say, Journ. Acad. Nat. Sci. Philadelphia, i. 1818, p. 250.

Description.—Dorsal surface smooth and more or less polished between the carinæ. Breadth of carapace behind antero-lateral teeth about one-half of its length. Anterior margin on either side of rostral plate concave and slightly oblique, tips of strong antero-lateral teeth not nearly reaching level of frontal edge.

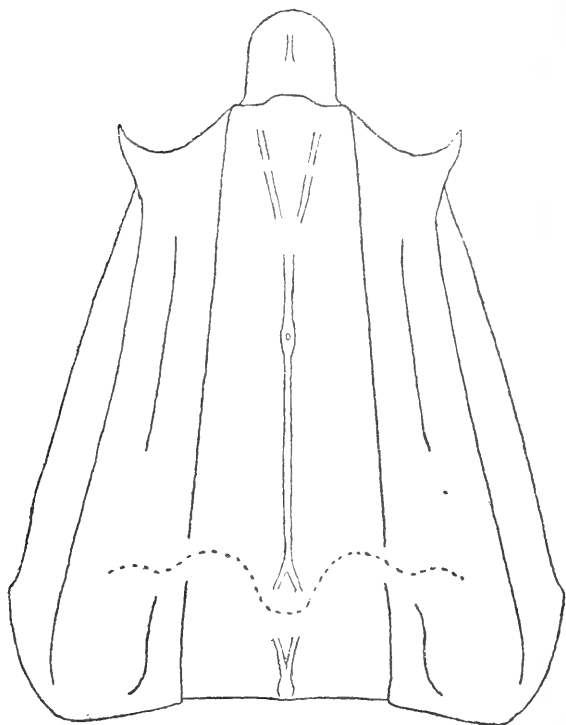
All carinæ of carapace well marked. Median carina forked in front and behind; in full-grown specimens it is always interrupted just where it divides anteriorly, and in some specimens the limbs of the fork are almost obliterated. Dorsal pit a little nearer to the frontal margin than to the cervical groove; anterior fork of median carina extending not more than two-thirds of the distance from frontal margin to dorsal pit. Lateral margin of carapace distinctly angled posteriorly.

Rostral plate nearly as long as it is broad at the base, nearly parallel-sided, with a short but distinct median carina.

Anterior lobe of ocular somite rounded, with a shallow median notch. Eyes with corneal axis about equal to peduncular axis, set obliquely.

Dorsal processes of antennular somite directed forwards. Antennular peduncle shorter than carapace.

Fig. 1.



Squilla africana, sp. n. Carapace, with rostral plate, from above.

Third segment of mandibular palp about twice as long as second.

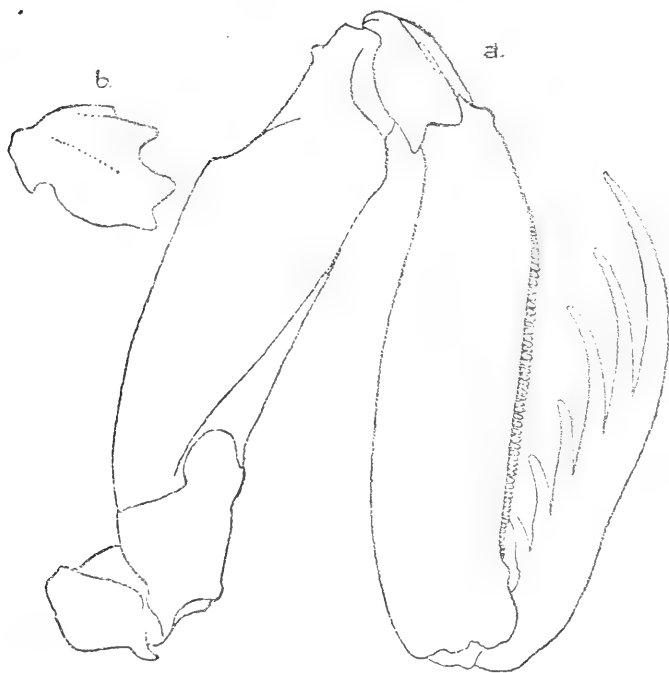
Raptorial limb with a strong curved tooth posteriorly on distal edge of proximal segment; carpus with an undivided ridge ending in a rectangular tooth on its anterior surface; propodus more than three times as long as wide, its pectinated

edge ending distally in a very slight tubercle. Dactylus with six teeth, including the terminal one.

Fifth thoracic limb without epipodite.

Free thoracic somites with well-marked submedian and intermediate carinæ not ending in spines. Fifth somite with lateral teeth undivided, acute, and strongly curved, so that the points are turned almost directly forwards. Lateral plates of sixth and seventh somites less acute than in *S. empusa*.

Fig. 2.



Squilla africana, sp. n. *a*, raptorial limb from the side, showing the hook-like tooth on the proximal segment and other characters; *b*, carpus, seen obliquely from in front, showing the ridge on the anterior face.

Abdominal somites with well-marked carinæ. Lateral carinæ ending in spines on all the somites, the intermediate, as a rule, on all except the first and second, and the submedian only on the sixth.

Telson resembling that of *S. empusa*, but with marginal teeth usually longer and more slender; six to eight denticles

between the submedian teeth, six to eight on each side between submedian and intermediate, and one between intermediate and lateral. Marginal thickenings at bases of denticles and teeth not confluent in either sex. Exopod of uropods with seven or eight spines on proximal segment.

A good deal of dark pigment persists in spirit-specimens, the whole dorsal surface being usually sprinkled with minute chromatophores; the most conspicuous and constant markings are a posterior marginal line on each of the free thoracic and abdominal somites, a short transverse band on the tergum of the third abdominal somite, and a conspicuous blotch on the exopod of the uropods, occupying the distal portion of the first segment and the inner edge of the second.

Total length up to 138 mm.

Holotype.—Male from Lagos, West Africa. Total length (tip of rostrum to tip of submedian telson spines) 134 mm.; length of carapace in median line (excluding rostrum) 27.75 mm. Presented by Mr. J. Cadman. Brit. Mus. reg. no. 1914. 11. 30. 17.

Paratypes in Brit. Mus.—The Gambia (4 sps.); Sierra Leone (1 sp.); Lagos (3 lots, 11 sps.); the Gaboon (2 lots, 2 sps.); West Africa (1 sp.).

Remarks.—The West-African specimens referred by Mr. Miers to the North-American *Squilla empusa*, Say, prove, on re-examination, to belong to this very distinct species. Although closely resembling both *S. empusa* and the Mediterranean *S. mantis*, Latreille, it differs from them in having epipodites only on the first four (instead of five) pairs of thoracic appendages, and in the presence of a tooth on the proximal segment and an undivided ridge (instead of two or three teeth) on the carpus of the raptorial limbs. It agrees with *S. mantis* and differs from *S. empusa* in the relative positions of the dorsal pit and the anterior bifurcation on the median carina of the carapace; but it resembles *S. empusa* in the shorter corneal axis of the eyes and in the pigmentation (so far as it is retained in spirit-specimens), especially in the dark spot on the uropods.

The fact that all the West-African specimens of *Squilla* in the Museum collection belong to this new species makes it probable that all records of *S. empusa* from that region refer to *S. africana*. Jurich's elaborate description (*l. c.*) of a solitary specimen from the Congo does not mention a single one of the distinctive characters, but his figure shows, in the position of the dorsal pit of the carapace, the strongly procurved processes of the fifth thoracic somite, and, less distinctly, in the undivided ridge on the carpus, features that are peculiar to *S. africana*.

BIBLIOGRAPHICAL NOTICE.

Antarctic and Subantarctic Fishes.

1. E. R. WAITE. *Fishes. Australasian Antarctic Expedition.* Scientific Reports, Series C, Vol. III. Pt. 1. Pp. 1-92, pls. i.-v., maps i., ii.
2. W. F. THOMPSON. *Fishes collected by the 'Albatross' during 1888 between Uruguay and Chile, on the Voyage through the Straits of Magellan.* Proc. U.S. Nat. Mus. L. 1916, pp. 401-476, pls. ii.-vi.

MR. E. R. WAITE's important and finely illustrated memoir on the fishes of the Australasian Antarctic Expedition is especially valuable in that it gives the first account of the fishes of Adelie Land, Queen Mary Land, and Macquarie Island.

Of 28 species obtained off the coasts of Antarctica 23 are *Nototheniiformes*; 4 of these are new, but the majority of the remainder were already known from Victoria Land, and it is evident that the fish-fauna of Adelie Land and Queen Mary Land is essentially the same as that of Victoria Land. Two species, *Gerlachea australis* and *Dolloidraco longidorsalis*, hitherto known only from Graham Land, were taken off Queen Mary Land, adding to the number of fishes with a circumpolar distribution. *Cryodraco antarcticus* is also recorded from Queen Mary Land, but there can be little doubt that the example obtained was *C. atkinsoni*, and I am disinclined, on the present evidence, to accept Mr. Waite's view that these two species are identical.

Of the four new species, three belong to the family *Bathydracnidae*; one of these is a *Bathydraco*, the second belongs to a new genus—*Aconichthys*—distinguished from *Bathydraco* by the presence of three lateral lines, and the third is made the type of a new genus—*Cygnodraco*—which is doubtfully distinct from *Parachenichthys*, since actual examination of specimens shows that in the last-named genus the lateral line has no bony plates, and it is principally on their absence that Mr. Waite relies in defining his new genus. The fourth new species is a new generic type in the family *Chænichthyidae*; the reduced spinous dorsal fin and the presence of a lower lateral line at the base of the anal fin distinguish it from *Champscephalus*.

Of the five species that are not *Nototheniiformes*, two are *Macrurids* that were obtained by the 'Scotia' off Coats Land, two are *Zoarceids* first described from the collection made by the 'Gauss' at Wilhelm Land, and the fifth is a *Paraliparis* that will probably prove, if actual comparison can be made, to be specifically identical with *P. antarcticus*, taken by the 'Terra Nova' to the south of the Balleny Islands.

Of the ten species recorded from Macquarie Island, five are

pelagic or bathypelagic. A large shark appears to be the southern representative of the arctic *Somniosus microcephalus*; the Myctophidæ are *Myctophum antarcticum*, a widely distributed species, and *Lampanyctus braueri*, previously known from off Coats Land and from N.E. of the Falklands. A new genus and species, *Notosudis hamiltoni*, is of doubtful position, but seems to have much in common with *Scopelosaurus*, Bleek., and *Idiacanthus aurora*, described as new, appears to be a synonym of *I. niger*, Regan. Examination of the type of the last-named species shows that it has the number of vertebræ and of branchiostegals given by Waite; of the supposed differences the backward position of the ventrals and more forward position of the anal relatively to the ventrals are discounted by the statement that "having floated off with the skin the actual position of the ventral fins cannot be ascertained with certainty"; differences in the preservation of the specimens and in method of measurement may account for the apparently larger eye of *I. aurora*, and the fact that the barbel is attached to the basihyal and has no fixed point of origin in relation to the mandible explains an apparent difference in its position.

The coast-fishes of Macquarie Island are of much greater interest than the pelagic or bathypelagic species that happened to be taken near it. The determination of four of the five species listed by Waite cannot be questioned, but the other, which he calls *Nothenia coriiceps*, var. *macquariensis*, appears to differ from *N. coriiceps* in the fewer dorsal rays and broader interorbital region—just the characters used to define *N. rossii* in my synopsis of the genus. Comparing the fish described and figured by Waite with examples of *N. rossii*, of which there is now a large series from South Georgia in the Natural History Museum, I conclude that it belongs to that species, the type of which is from an unknown locality, but was quite likely taken at Kerguelen.

The known distribution of the five species from Macquarie Island may be shown in tabular form:—

	Magellan.	Graham Land and S. Georgia.	Kerguelen.	Antipodes.
<i>Notothenia rossii</i>	+	?	..
— <i>macrocephala</i>	+	..	+	+
— <i>colbecki</i>	+
<i>Harpagifer bispinis</i>	+	+	+	..
<i>Zanclorhynchus spinifer</i>	+	..

It is very interesting to find that the relationship with Kerguelen, more than 3000 miles distant, but on nearly the same isotherm, appears to be closer than with the subantarctic islands of New Zealand, only some 400 miles to the north-east.

A new genus and species of Bovichthyidæ—*Aurion effulgens*—is described from a specimen taken in 50° 60' S., 165° E. This has many features in common with *Bovichthys decipiens*, Günth., also taken in the open sea (50° S., 170° W.); but re-examination of the

type of the latter reveals no trace of the curious leaf-like luminous organs on the snout that characterize the new genus.

Mr. Thompson's paper includes a revision of the species of *Notothenia* found in the Magellan district. He describes as new *N. longicauda*, *gilberti*, *latifrons*, and *jordani*, which will probably prove to be synonyms of *N. brevicauda*, *tessellata*, *microlepidota*, and *ramsayi* respectively; but as the types of two of the supposed new species measure only about 60 mm. in total length, it is difficult to place them with certainty. Mr. Thompson separates *N. squamiceps* from *N. sima*, and unites *N. wiltoni* with *N. longipes*; re-examination of the specimens in the Natural History Museum does not lead me to accept these conclusions. It may be noted that if I am correct in regarding *N. latifrons* as the young of *N. microlepidota*, the number of species of this genus common to the Magellan and Antipodes districts is increased to three, *N. microlepidota*, *macrocephala*, and *cornucola*; records of *N. coriiceps* in these districts appear to refer to the last-named.

There can be little doubt that *Idiacanthus retrodorsalis* is another synonym of *I. niger*, so that this species, first described in 1914 from off Cape North, New Zealand, has since been redescribed from near Macquarie Island and off Lota, Chile. C. TATE REGAN.

MISCELLANEOUS.

New South-American Arctiadae (Joicey & Talbot, Ann. & Mag. Nat. Hist. ser. 8, vol. xviii. pp. 53-62).

EXPLANATION OF PLATE XIV.

- Fig. 1. *Thyractia semivitreæ*, ♂, p. 53.
- Fig. 2. *Prumala sulphurea*, ♀, p. 54.
- Fig. 3. *Neonerita yahuasæ*, ♂, p. 54.
- Fig. 4. *Aræomolis hamatoneura*, ♂, p. 55.
- Fig. 5. — *guianensis*, ♀, p. 56.
- Fig. 6. *Parævia guianensis*, ♀, p. 56.
- Fig. 7. *Automolis metallica*, ♂, p. 57.
- Fig. 8. *Melese costimacula*, ♀, p. 57.
- Fig. 9. — *signata*, ♂, p. 58.
- Fig. 10. — —, ♀.
- Fig. 11. — *nebulosa*, ♀, p. 58.
- Fig. 12. *Hyperthæma reducta*, ♂, p. 59.
- Fig. 13. — —, ♀.
- Fig. 14. *Carathis tabaconas*, ♂, p. 59.
- Fig. 15. *Pelochyta suffusa*, ♂, p. 60.
- Fig. 16. *Sychesia omissus*, Roths., ♂.
- Fig. 17. *Élysus mediofasciata*, ♂, p. 60.
- Fig. 18. *Hemihyalea hamptoni*, ♂, p. 61.
- Fig. 19. *Neritos flavimargo*, ♂, p. 61.
- Fig. 20. *Æmia castanea*, ♂, p. 62.
- Fig. 21. *Hyponerita hamoides*, ♂, p. 62.

Office of Secretary to International Commission on Zoological Nomenclature. Smithsonian Institution, United States National Museum, Washington, D.C.

Notice of Possible Suspension of the Rules of Nomenclature in the Cases of Holothuria, 1758, vs. Physalia, 1801, and Bohadschia, 1833, vs. Holothuria, 1791.

IN accordance with the requirements prescribed by the International Congress of Zoology, notice to the zoological profession is hereby given that on or about October 1, 1917, the undersigned proposes to recommend to the International Commission on Zoological Nomenclature that the Rules be suspended in the following cases:—

Holothuria, Linn., 1758 (type *physalis*), vs. *Physalia*, Lamarck, 1801 (type *pelagica*). The effect of suspension will be to retain *Physalia* as generic name for the Portuguese Man of War.

Bohadschia, Jaeger, 1833, vs. *Holothuria*, Bruguière, 1791. The effect of the suspension will be to retain *Holothuria* for the Sea Cucumbers.

The motion for suspension includes the following points:—

- (1) Suspend the Rules in the case of the generic names in question;
- (2) Permanently reject *Holothuria*, 1758, type *physalis*;
- (3) Validate *Physalia*, 1801, type *pelagica* (syn. *physalis*, 1758);
- (4) Accept *Holothuria* as dating from Bruguière, 1791, despite the existence of *Holothuria*, 1758 (if rejected);
- (5) Said suspension is not to be construed as invalidating any specific name.

The grounds advanced for suspension will be:—

(a) A strict application of the Rules in these cases will result in greater confusion than uniformity, because

(b) The cases involve a transfer of generic names, almost universally accepted in the sense given above since 1791 (for *Holothuria*) and since 1801 (for *Physalia*), to genera in other groups in connection with which they have been used by only a very few authors during more than 100 years.

The undersigned cordially invites zoologists to communicate, not later than September 1, 1917, to him or to any other member of the Commission, either their approval or disapproval of the proposed action.

C. W. STILES,
Secretary to Commission.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[EIGHTH SERIES.]

No. 107. NOVEMBER 1916.

XLVI.—*A Revision of the "Cribrimorph" Cretaceous Polyzoa.* By W. D. LANG, M.A., F.Z.S.

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[Concluded from p. 112.]

B. *Andrioporidae*, fam. nov.

Uniserial and multiserial Cheilostome Polyzoa of small size ($\frac{1}{3}$ — $\frac{1}{2}$ mm. in length), in which the intraterminal front wall is formed of costæ which, arching over, fuse along the middle line and do not, as a rule, bend upwards and become free spines; where this is the case, however, the free continuations of the costæ are solid; lateral fusions may take place between the costæ, and costal fusion may be so complete that the boundaries between the costæ may nearly or quite vanish; very little secondary tissue is developed between the æcia or in connection with the apertures; avicularia are minute, primitively blunt, secondarily pointed; apertural spines, if present, six in number, sometimes thickened, but never so in connection with secondary tissue; no fusions take place between outgrowths of the apertural bar and the apertural spines.

Tabular Diagnoses of the Subfamilies.

- A. Costæ are not specially flattened, and bear neither a median row of pores nor a median slit; nor do they occasionally fuse with

- their neighbours completely, so as to produce a costa of double thickness a. *Andrioporinae*.
 B. Costæ are more or less flattened and bear a median row of pores; a costa occasionally completely fuses with its neighbour, forming a costa of double width b. *Phlophlæinae*.
 C. Costæ bear a median slit c. *Schistacanthoporinae*.

a. *ANDRIOPORINÆ*, subfam. nov.

Tabular Diagnoses of the Genera.

- A. Uniserial, incrusting.
 I. Avicularia generally present; intraterminal front wall simply arched and costæ more or less fused I. *Andriopora*.
 II. Avicularia absent; intraterminal front wall entirely fused, traces only of the costæ remaining, and apertural bar forming a hump II. *Corymbopora*.
 B. Multiserial (except sometimes in neanastic stages), incrusting.
 I. No secondary aperture.
 a. Median area of fusion not surrounded by a circle of spines.
 1. Apertural bar not forming a hump.
 a. Avicularia numerous or, if few, not medianly placed.
 I. Furrows between costæ plainly visible.
 a. Apertural spines not markedly thickened.
 1. Apertural bar not flattened and produced vertically, so as to form a rudimentary proximal shield.
 a. Apertures very primitive (subsemicircular) III. *Polyceratopora*.
 β. Apertures not very primitive.
 a. Larger, not so squat, and apertural spines not at all thickened IV. *Argopora*.
 b. Smaller, squat, and apertural spines slightly thickened.
 1. Œcia not separated by much circum-avicularian tissue V. *Nannopora*.
 2. Œcia separated by much circum-avicularian tissue (? kenœcia) VI. *Distansescharella*.
 2. Apertural bar much flattened vertically, forming a rudimentary proximal shield VII. *Angelopora*.
 b. Apertural spines decidedly thickened.
 1. Apertural bar produced into a median spine VIII. *Eucheilopora*.
 2. Apertural bar not produced into a median spine.
 a. Avicularia absent IX. *Kankopora*.
 β. Avicularia few, pointed X. *Oligotopora*.

- II. Furrows between costæ almost or quite invisible XI. *Tricolpopora*.
- β. Avicularia few and generally one placed distally to each cecum; proximal pair of apertural spines tend to be thickened. XII. *Monoceratopora*.
- 2. Apertural bar forms a hump XIII. *Hyhopora*.
- 3. An avicularium medianly placed above apertural bar; secondary tissue covers intraterminal front wall XIV. *Hippiopora*.
- b. Median area of fusion surrounded by a ring of solid spines; apertural spines thickened XV. *Æolopora*.
- II. A secondary aperture more or less formed.
 - a. Proximal shield of secondary aperture formed by the upward growth of a flattened shield-shaped apertural bar, not displaying a thickened median spine; distal shield formed by fusion of distal spines XVI. *Auchenopora*.
 - b. Proximal shield of secondary aperture formed by the general upward growth of the apertural bar and the backward growth of its median spine, the end (at least) of which fuses with the median line of the intraterminal front wall; apertural spines retain their identity and do not form, in the absence of ovicells, a complete distal shield XVII. *Pancheilopora*.
- C. Erect, cylindrical.
 - I. Intraterminal front wall not so completely fused; ovicells with radial sculpture XVIII. *Lekythoglena*.
 - II. Intraterminal front wall completely fused. XIX. *Holostegopora*.

I. ANDRIOPORA, gen. nov.

Genotype. *A. homunculus*.

Tabular Diagnoses of the Species.

- A. Apertural spines not markedly thickened.
 - I. Apertural bar not produced vertically nor much compressed in a vertical plane.
 - a. Costal fusions less perfect; costæ about 16.
 - 1. Shorter; apertural bar not very wide.
 - α. Caudæ short or none; capitula rounded. 1. *A. brevis*.
 - β. Caudæ longer; capitula not so rounded. 2. *A. möckleri*.
 - 2. Longer; apertural bar very wide; caudæ shorter; capitula long and narrow..... 3. *A. arion*.
 - b. Costal fusions more perfect; a tendency to solid spines at median area of fusion; costæ 20..... 4. *A. gallica*.
 - II. Apertural bar produced vertically or flattened in a vertical plane to form a rudimentary proximal apertural shield.
 - a. Apertural bar much flattened in a vertical

- plane; avicularia directed inwards; costæ 15-22 5. *A. homunculus*.
- b. Apertural bars somewhat flattened and sloping proximally; avicularia directed outwards; costæ 14-15.
1. Caudæ short 6. *A. linearis*.
2. Caudæ long 7. *A. porrecta*.
- c. Apertural bar very slightly flattened and produced vertically in a median spine; costæ 16-18 8. *A. limax*.
- B. Apertural spines decidedly thickened.
- I. Œcia stout; caudæ short or none.
1. Costæ slightly fused; apertural bar with median process; costæ about 12 9. *A. gasteri*.
2. Costæ firmly fused; apertural bar not specially modified; costæ about 20 10. *A. frequens*.
- II. Œcia meagre; caudæ long.
1. Costæ slightly fused; about 9 11. *A. leviseni*.
2. Costæ firmly fused; about 18 12. *A. aggregata*.

1. *A. [Hippothoa] brevis* (Reuss.), 1872, *Palaeontographica*, vol. xx. part 1, p. 100, pl. xxiv. fig. 1; Cenomanian; Saxony.

2. *A. möckleri*, sp. n.

Type-specimen. British Museum, D. 23020; Chalk Marl; Cambridge.

3. *A. arion*, sp. n.

Type-specimen. British Museum, D. 25544; low in *cortestudinarium*-zone; S.E. of Boxmoor, Herts.

4. *A. gallica*, sp. n.

Type-specimen. British Museum, D. 28480; Coniacian; Fécamp, France.

5. *A. homunculus*, sp. n.

Type-specimen. British Museum, D. 8212; *Holaster planus*-zone; Borstal, S.W. of Chatham, Kent.

6. *A. [Cribrilina] linearis* (Vine), 1893, Rep. Brit. Ass. for 1892, Edinburgh, p. 316. *Type-specimen*. British Museum, D. 2638; Lower Senonian; Chatham, Kent.

7. *A. porrecta*, sp. n.

Type-specimen. British Museum, D. 7308; *coranguinum*-zone; Charlton, Kent.

8. *A. limax*, sp. n.

Type-specimen. British Museum, D. 21953; *cortestudinarium*-zone; Luton, S.E. of Chatham, Kent.

9. *A. gasteri*, sp. n.

Type-specimen. British Museum, D. 28249; *cortestudinarium*-zone; Cuckmere Haven, Sussex.

10. *A. frequens*, sp. n.

Type-specimen. British Museum, D. 28252; *cortestudinarium*-zone; Cuckmere Haven, Sussex.

11. *A. levinseni*, sp. n.

Type-specimen. British Museum, D. 28235; *mucronatus*-zone; Rügen.

12. *A. [Hippothoa] aggregata* (Marsson), 1887, Pal. Abh. vol. iv. part I, p. 92, pl. ix. fig. 10; *mucronatus*-zone; Rügen.

II. CORYMBOPORA, gen. nov.

Genotype. *C. reliqata*, sp. n. *Type-specimen.* British Museum, D. 28488; Cenomanian, Korycaner Schichten; Kank, Bohemia.

III. POLYCERATOPORA, gen. nov.

Genotype. *P. [Lepralia] englypha* (Novák), 1877, Denks. k. Acad. Wiss. Wien, vol. xxxvii. part ii. p. 92, pl. i. figs. 10-11; Cenomanian, Korycaner Schichten; Bohemia.

IV. ARGOPORA, gen. nov.

Genotype. *A. segnis*.

Tabular Diagnoses of the Species.

- | | |
|---|------------------------|
| A. Costæ about 16; length about $\frac{1}{2}$ mm. | 1. <i>A. segnis</i> . |
| B. Costæ about 20. | |
| I. Smaller, nearer $\frac{1}{3}$ mm. in length; secondary tissue surrounds avicularia | 2. <i>A. pigra</i> . |
| II. Larger; no secondary tissue surrounds avicularia | 3. <i>A. improba</i> . |

1. *A. segnis*, sp. n.

Type-specimen. British Museum, D. 4047; Lower Senonian; Chatham, Kent.

2. *A. pigra*, sp. n.

Type-specimen. In collection of M. Canu (a photograph of type-specimen in British Museum); Coniacian or Campanian; La Bonneville, France.

3. *A. improba*, sp. n.

Type-specimen. British Museum, D. 28912; *quadratus*-zone, *depressa*-subzone; E. of Brighton, Sussex.

V. NANNOPORA, gen. nov.

Genotype. *N. pygmea*.

Tabular Diagnoses of the Species.

- | | |
|--|----------------------------|
| A. Apertures hardly "cribriline" | 1. <i>N. paternensis</i> . |
| B. Apertures entirely "cribriline." | |
| I. Celia close together | 2. <i>N. pygmea</i> . |
| II. Celia somewhat separate..... | 3. <i>N. lepidu</i> . |

1. *N. paternensis*, sp. n.

Type-specimen. British Museum, D. 28455; Coniacian; St. Paterne, France.

2. *N. [Reptescharella] pygmea* (d'Orbigny), Pal. Franç. 1852, pl. 716. figs. 7-8, 1853, p. 468; Senonian; Sainte-Colombe, France; interpreted according to Canu's identification of a specimen from Tours or Villedieu, in his collection (a photograph of this specimen is in the British Museum).

3. *N. lepidu*, sp. n.

Type-specimen. In collection of M. Canu (a photograph of type-specimen in British Museum); [Senonian]; Tours or Villedieu, France.

VI. DISTANSESCHARELLA, d'Orbigny, 1853,
Pal. Franç. p. 463.

Genosyntypes. *Cellepora familiaris*, von Hagenow, 1839, Neues Jahrbuch, p. 274.

Escharina inflata, Römer, 1840, Verst. norddeutsch. Kreidegeb. p. 14, pl. v. fig. 5.

Escharina radiata, Reuss, 1846, Verst. böhm. Kreid. Abt. ii. p. 68, pl. xv. fig. 19.

Genolectotype. *D. familiaris*.

M. Canu has identified a specimen in his collection as *Distansescharella* according to d'Orbigny's collection, and evidently relies on the distance apart of the normal œcia, with avicularia packed between, as diagnostic; this is not so in *Escharina radiata*, Reuss, and there appear to be no avicularia in *E. inflata*, Römer; presumably, therefore, d'Orbigny interpreted *Distansescharella* on *Cellepora familiaris*, Hagenow. This form is, consequently, selected as the genotype, though it appears never to have been figured nor adequately described; the genus can, however, be interpreted provisionally by M. Canu's specimen.

1. *D. d'orbignyi*, sp. n.

Type-specimen. In collection of M. Canu (a photograph of type-specimen in British Museum); Comiacian; Ville-dieu, France.

VII. ANGELOPORA, gen. nov.

Genotype. *A. nuntia*, sp. n. *Type-specimen*. British Museum, D. 21214; *coranguinum*-zone; Wooburn Green, Bucks.

VIII. EUCHEILOPORA, gen. nov.

Genotype. *E. labiosa*.

Tabular Diagnoses of the Species.

A. Costæ about 12, œcia small, about $\frac{1}{2}$ mm.	1. <i>E. pediculosa</i> .
B. Costæ about 16.	
I. Smaller, about $\frac{1}{3}$ mm.	2. <i>E. labelliosa</i> .
II. Larger, about $\frac{1}{2}$ mm.	3. <i>E. labiosa</i> .
C. Costæ about 20-24.	
I. Avicularia present.	
a. Smaller, about $\frac{1}{3}$ mm.	4. <i>E. lepida</i> .
b. Larger, about $\frac{1}{2}$ mm.	5. <i>E. crassescens</i> .
II. Avicularia absent	6. <i>E. radiata</i> .

1. *E. pediculosa*, sp. n.

Type-specimen. British Museum, D. 11463; Lower Senonian; Hertford.

2. *E. labellosa*, sp. n.

Type-specimen. In collection of M. Canu (a photograph of type-specimen in British Museum); Coniacian; Lille, France.

3. *E. labiosa*, sp. n.

Type-specimen. British Museum, D. 28250; *cortestudinarium*-zone; Lewes, Sussex.

4. *E. lepida*, sp. n.

Type-specimen. In collection of M. Canu (a photograph of type-specimen in British Museum); Coniacian; Lisle.

5. *E. crassescens*, sp. n.

Type-specimen. British Museum, D. 28910; *cortestudinarium*-zone; Cuckmere Haven, Sussex.

6. *E.* [*Escharina*] *radiata* (Römer), 1840, Verst. norddeutsch. Kreidegeb. p. 13, pl. v. fig. 4; Senonian or Turonian; Peine, Germany.

IX. KANKOPORA, gen. nov.

Genotype. *K. kankensis*.

Tabular Diagnoses of the Species.

A. Costæ 8-10	1. <i>K. kankensis</i> .
B. Costæ 12.....	2. <i>K. inflata</i> .

1. *K. kankensis*, sp. n.

Type-specimen. British Museum, D. 28494; Cenomanian, Korycaner Schichten; Kank, Bohemia.

2. *K.* [*Escharina*] *inflata* (Römer), 1840, Verst. norddeutsch. Kreidegeb. p. 14, pl. v. fig. 5; Cenomanian, Hils-conglomerat; Essen, Germany.

X. OLIGOTOPORA, gen. nov.

Genotype. *O. novaki*, sp. n. = *Lepralia pediculus*, Novak. 1877, Denk. k. Acad. Wiss. Wien, vol. xxxvii. part ii. p. 93, pl. i. fig. 12; Turonian, Teplitzer Schichten; Hundorf,

Bohemia. Non *Lepralia pediculus*, Reuss, 1874, Palaeontographica, vol. xx. part ii. p. 129, pl. xxiv. fig. 16; Turonian, ob. Planer; Strehlen, Saxony.

XI. TRICOLPOPORA, gen. nov.

Genotype. *T. trisinuata*, sp. n. *Type-specimen*. British Museum, D. 28447; Coniacian; St. Avertin, France.

XII. MONOCERATOPORA, gen. nov.

Genotype. *M. unicornis*.

Tabular Diagnoses of the Species.

- A. Apertural bar undifferentiated, costæ about 18; apertures primitive (subsemicircular).
 - I. Proximal apertural spines hardly thickened; apertures less primitive *M. lewesiensis*.
 - II. Proximal apertural spines decidedly thickened; apertures more primitive *M. gamblei*.
- B. Apertural bar with median process and flattened in a vertical plane; apertures about semicircular *M. unicornis*.

1. *M. lewesiensis*, sp. n.

Type-specimen. British Museum, D. 28248; *Holaster planus*-zone; Malling Hill, Lewes, Sussex.

2. *M. gamblei*, sp. n.

Type-specimen. British Museum, D. 28530; Lower Senonian; Chatham, Kent.

3. *M. unicornis*, sp. n.

Type-specimen. British Museum, D. 28247; *coranguinum*-zone; W. of Beachy Head, Sussex.

XIII. HYBOPORA, gen. nov.

Genotype. *H. gibba*, sp. n. *Type-specimen*. British Museum, D. 28493; Cenomanian, Korycaner Schichten; Kank, Bohemia.

XIV. HIPPIOPORA, gen. nov.

Genotype. *H. equestris*, sp. n. *Type-specimen*. British Museum, D. 28909; *quadratus*-zone, *pillula*-subzone; North Lancing, Sussex.

XV. *ÆOLOPORA*, gen. nov.Genotype. *A. distincta*.*Tabular Diagnoses of the Species.*

- A. Tubercles on median line of fusion 14–16, those on the apertural bar being well developed. Apertural bar less flattened in a vertical plane. 1. *A. distincta*.
 B. Tubercles on median line of fusion 12–14, those on the apertural bar being absent or poorly developed. Apertural bar more flattened in a vertical plane 2. *A. stellata*.

1. *A. distincta*, sp. n.

Type-specimen. British Museum, D. 28062; *coranguinum*-zone; Upper Basildon, Berks.

2. *A. stellata*, sp. n.

Type-specimen. British Museum, D. 28911; *quadratus*-zone, *pillula*-subzone; North Lancing, Sussex.

XVI. *AUCHENOPORA*, gen. nov.

Genotype. *A. guttur*, sp. n. *Type-specimen.* British Museum, D. 28219; Danian; Faxø, Denmark.

XVII. *PANCHEILOPORA*, gen. nov.

Genotype. *P. magnilabrosa*, sp. n. *Type-specimen.* British Museum, D. 28911; *quadratus*-zone, *depressa*-subzone; E. of Brighton, Sussex.

XVIII. *LEKYTHOGLA*, Marsson, 1887, Pal. Abh. vol. iv. part 1, p. 90.

Genosyntypes. *L. ampullacea*, Marsson, 1887, *op. cit.* p. 91, pl. ix. fig. 7.

L. effigurata, Marsson, 1887, *op. cit.* p. 91, pl. ix. fig. 8.

Genolectotype. *L. ampullacea*, Marsson, 1887, *loc. cit.*; *mucronatus*-zone; Rügen, Germany.

XIX. *HOLOSTEGOPORA*, gen. nov.

Genotype. *H. epsomensis*, sp. n. *Type-specimen.* British Museum, D. 23959; top of *coranguinum*-zone; Epsom, Surrey.

b. *PLIOPHLÆINÆ*, subfam. nov.

Tabular Diagnoses of the Genera.

- A. Furrows between the costæ visible I. *Pliophlæa*.
 B. Furrows between the costæ obliterated, and
 intraterminal front wall completely fused II. *Trilophopora*.

I. *PLIOPHLÆA*, Gabb & Horn, 1862, Journ. Acad. Nat. Sci.
 Philadelphia, ser. ii. vol. v. p. 150.

Genotype. *P. sagena*.

Tabular Diagnoses of the Species.

- A. Apertures not markedly pliophlæine (apertural
 bar bent into a V-shape—otherwise "cribri-
 line").
 I. Intercostal fusions not obvious.
 1. Apertural bar not medianly produced as a
 flat projection.
 a. Œcia not very long ($\frac{1}{3}$ to little more than
 $\frac{1}{2}$ mm.).
 1. Avicularia broad and blunt.
 a. Œcia $\frac{1}{2}$ mm. or more in length 1. *P. striata*.
 β. Œcia about $\frac{1}{3}$ in length 2. *P. pupoides*.
 2. Avicularia narrow and more or less
 sharp.
 a. Aperture hardly cribriline.
 a. Intercostal furrows almost vanish . 3. *P. cicatricifera*.
 b. Intercostal furrows conspicuous .. 4. *P. elegantula*.
 β. Aperture cribriline to slightly pliophlæine 5. *P. palea*.
 b. Œcia very long ($\frac{2}{3}$ mm.—1 mm.) and nar-
 row 6. *P. brongniarti*.
 2. Apertural bar produced medianly as a flat
 projection 7. *P. columbina*.
 II. Intercostal fusions obvious.
 a. Costæ 16–18 8. *P. sagena*.
 b. Costæ 13–15.
 1. Apertures hardly cribriline 9. *P. ostreicola*.
 2. Apertures cribriline—slightly pliophlæine 10. *P. gluma*.
 B. Apertures remarkably pliophlæine.
 A. Intraterminal front wall flatter 11. *P. cornuta*.
 B. Intraterminal front wall more arched 12. *P. subvitrea*.

1. *P. striata*, sp. n.

Type-specimen. British Museum, D. 15415; *mucronatus*-
 zone; Rügen, Germany.

2. *P. [Reptescharella] pupoides* (d'Orbigny), Pal. Franç.
 1852, pl. 716. figs. 13–15, 1853, p. 470; Senonian
 [Campanian]; Royan, France. Interpreted according

to M. Canu's identification of a specimen from the Campanian of Roux, France, in his collection. (A photograph of this specimen is in the British Museum.)

3. *P. [Cribrilina] cicatricifera* (Brydone), 1914, Geol. Mag. dec. vi. vol. i. p. 97, pl. iv. figs. 1-2; Senonian; England.

4. *P. [Cellepora, Escharina] elegantula* (von Hagenow), 1851, Bry. Maastr. Kreid. p. 90, pl. x. fig. 13; Maas-trichtian; Maastricht (non *Reptescharipora elegantula*, Beissel, 1865, Bry. Aach. Kreid., Nat. Verh. holl. Maatsch. Wet. Haarlem, ser. ii. vol. xxii. Art. 3, p. 60, pl. vii. fig. 82, which is *P. cornuta*, vide infra).

5. *P. palea*, sp. n.

Type-specimen. British Museum, D. 28221; Danian; Faxe, Denmark.

6. *P. [Cellepora, Escharina] brongniarti* (Hagenow), 1851, Bry. Maastr. Kr. p. 90, pl. x. fig. 14; Maastrichtian; Maastricht.

7. *P. columbina*, sp. n.

Type-specimen. British Museum, D. 27749; Santonian; Coulommiers, France.

8. *P. [Flustra] sagena* (Morton), 1834, Synop. Organ. Cret. United States, p. 79, pl. xiii. fig. 7; [Danian]; New Jersey, U.S.A.

9. *P. [Cribrilina] ostreicola* (Brydone), 1909, Geol. Mag. dec. v. vol. vi. p. 399, pl. xxiii. figs. 1-2; *mucronatus*-zone; Trimingham, Norfolk.

10. *P. gluma*, sp. n.

Type-specimen. British Museum, D. 28233; Danian; Faxe, Denmark.

11. *P. [Cellepora] cornuta* (Hagenow), 1839, Neues Jahrbuch, p. 271; *mucronatus*-zone; Rügen, Germany. Interpreted by Hagenow's later figure, 1851, Bry. Maastr. Kr. p. 89, pl. x. fig. 11; Maastrichtian;

Maastricht. = *Repteschariopora elegantula*, Beissel, 1865, Bry. Aach. Kreid. p. 60, pl. vii. fig. 82 (non = *C. elegantula*, Hagenow, 1851, *vide supra*). = *Cribrilina beisseli*, Brydone, 1909, Geol. Mag. dec. v. vol. vi. p. 399.

12. *P. [Cribrilina] subvitrea* (Brydone), 1909, Geol. Mag. dec. v. vol. vi. p. 399, pl. xxiii. figs. 3-4; *mucronatus*-zone; Trimingham, Norfolk.

II. TRILOPHOPORA, sp. n.

Genotype. *T. trifida*, sp. n. *Type-specimen*. British Museum, D. 28229; Danian; Faxø, Denmark.

c. *SCHISTACANTHOPORINÆ*, subfam. nov.

SCHISTACANTHOPORA, gen. nov.

Genotype. *S. fissæ*, sp. n. *Type-specimen*. In the collection of M. Canu [a photograph of type-specimen in the British Museum]; Maastrichtian; Royan.

C. *Lagynoporidae*, fam. nov.

Multiserial Cheilostome Polyzoa of moderate size (about $\frac{2}{3}$ mm. long, seldom less than $\frac{1}{2}$ mm. long), in which the intraterminal front wall is formed of costæ which fuse along the middle line, but there are seldom obvious intercostal fusions and no free spines in the median area of fusion; a general solidification of the intraterminal front wall takes place during evolution by the widening of the median area of fusion, by the closer juxtaposition of the costæ, and occasionally by definite intercostal fusions; a secondary aperture may be formed by means of a proximal shield composed of fusions of the proximal pair of apertural spines with a median process of the apertural bar—otherwise the family is singularly free from secondary tissue; apertural spines 4-6, typically and primarily 6, reduced in some cases to 4; avicularia few, fairly large and blunt, with oval apertures, tending to disappear; a large, more or less distally placed communication-pore present.

Tabular Diagnoses of the Subfamilies.

- A. A median process of the apertural bar present, which ultimately fuses with the proximal pair of apertural spines to form a proximal shield of a secondary aperture a. *Lagynoporinæ*.

- B. No secondary aperture, but apertural bar sharply bent proximally, and bearing no median process like that in A; avicularia rare or absent b. *Leptocheiloporinæ*.

a. *LAGYNOPORINÆ*, subfam. nov.

Tabular Diagnoses of the Genera.

- | | |
|---|----------------------------|
| A. Apertural spines always 6 | I. <i>Hexacanthopora</i> . |
| B. Apertural spines primitively 6, as shown in the neanastic cœcia, but finally 4. | |
| I. Costæ widely separate; median process of apertural bar thin | II. <i>Prodromopora</i> . |
| II. Costæ more or less closely juxtaposed; median process of apertural bar strongly developed | III. <i>Lagynopora</i> . |

I. *HEXACANTHOPORA*, gen. nov.

Genotype. *H. sexspinosa*.

Tabular Diagnoses of the Species.

- | | |
|--|------------------------------|
| A. Cœcia smaller (about $\frac{2}{3}$ mm.); costæ 18-20 .. | 1. <i>H. sexspinosa</i> . |
| B. Cœcia larger (more than $\frac{2}{3}$ mm.). | |
| I. Costæ 16 | 2. <i>H. kintburiensis</i> . |
| II. Costæ 14 | 3. <i>H. brightonensis</i> . |

1. *H. sexspinosa*, sp. n.

Type-specimen. British Museum, D. 21205; *Marsupites*-zone; Odiham, Hants.

2. *H. kintburiensis*, sp. n.

Type-specimen. British Museum, D. 21204; *quadratus*-zone; Kintbury, Berks.

3. *H. brightonensis*, sp. n.

Type-specimen. British Museum, D. 28890; *Marsupites*-zone; Brighton, Sussex.

II. *PRODROMOPORA*, gen. nov.

Genotype. *P. præcursor*, sp. n. *Type-specimen.* British Museum, D. 8351; *coranguinum*-zone; Gillingham, N.E. of Chatham, Kent.

III. LAGYNOPORA, gen. nov.

Genotype. *L. lagena*.

Tabular Diagnoses of the Species.

- A. Intercoastal fusions absent or not obvious.
- I. Œcia smaller (less than $\frac{1}{3}$ to $\frac{1}{2}$ mm. in length); costæ not so closely juxtaposed; avicularia, if present, smaller.
 - a. More costæ (about 18) 1. *L. birlingensis*.
 - b. Fewer costæ (about 14) 2. *L. saltdeanensis*.
 - II. Œcia larger ($\frac{2}{3}$ mm. or more in length); costæ closely juxtaposed; avicularia, if present, larger (except in *L. amphora*).
 - a. Intraterminal front wall more arched, costæ 15-20; length about $\frac{2}{3}$ mm.
 1. Intercoastal furrows less obvious 3. *L. furcifera*.
 2. Intercoastal furrows more obvious.
 - a. Œcia close together 4. *L. lagena*.
 - β. Œcia distant 5. *L. pediculus*.
 - b. Intraterminal front wall flatter; length more than $\frac{2}{3}$ mm.
 1. Median area of fusion less wide; intraterminal front wall less flat; costæ 16-18 6. *L. amphora*.
 2. Median area of fusion wider; intraterminal front wall flatter.
 - a. Costæ about 18 7. *L. urceolus*.
 - β. Costæ 13-15 8. *L. ampulla*.
 - B. Intercoastal fusions rather obvious 9. *L. horsleyensis*.

1. *L. birlingensis*, sp. n.

Type-specimen. British Museum, D. 28254; *coranguinum*-zone; W. of Beachy Head, Sussex.

2. *L. saltdeanensis*, sp. n.

Type-specimen. British Museum, D. 28896; *quadratus*-zone, *depressa*-subzone; E. of Brighton, Sussex.

3. *L. [Cribritina] furcifera* (Brydone), 1910, Geol. Mag. dec. v. vol. vii. p. 391, pl. xxx. figs. 6-8; Senonian; Suffolk.

4. *L. lagena*, sp. n.

Type-specimen. British Museum, D. 4042; Lower Senonian; Chatham, Kent.

5. *L. [Lepralia] pediculus* (Reuss), 1874, Palaeontographica, vol. xx. part ii. p. 129, pl. xxiv. fig. 16; Upper Turoonian; Strehlen, Germany.

6. *L. amphora*, sp. n.

Type-specimen. British Museum, D. 28255; *quadratus*-zone, *pillula*-subzone; W. of Newhaven, Sussex.

7. *L. urceolus*, sp. n.

Type-specimen. British Museum, D. 28889; *quadratus*-zone, *depressa*-subzone; E. of Brighton, Sussex.

8. *L. ampulla*, sp. n.

Type-specimen. British Museum, D. 28256; *quadratus*-zone; W. of Newhaven, Sussex.

9. *L. horsleyensis*, sp. n.

Type-specimen. British Museum, D. 28908; [high in] *coranguinum*-zone; West Horsley, N.E. of Guildford, Surrey.

b. *LEPTOCHEILOPORINÆ*, subfam. nov.

LEPTOCHEILOPORA, gen. nov.

Genotype. *L. tenuilabrosa*.

Tabular Diagnoses of the Species.

- | | |
|---|------------------------------|
| A. Cæcia very small—less than $\frac{1}{2}$ mm. long..... | 1. <i>L. vulnerata</i> . |
| B. Cæcia small, $\frac{1}{2}$ to $\frac{2}{3}$ mm. long. | |
| I. Apertural spines comparatively large; intra-terminal front wall well arched. | |
| a. Intercostal furrows very obscure | 2. <i>L. filiozati</i> . |
| b. Intercostal furrows clearly marked. | |
| 1. Costæ about 15, aperture hardly cribriline. | 3. <i>L. arcuata</i> . |
| 2. Costæ 16–20; aperture cribriline..... | 4. <i>L. languessensis</i> . |
| II. Apertural spines minute; intraterminal front wall flatter. | |
| a. Ovicells formed like the intraterminal front wall | 5. <i>L. tenuilabrosa</i> . |
| b. Ovicells plain | 6. <i>L. regularis</i> . |
| C. Cæcia larger—nearly 1 mm. long | 7. <i>L. magna</i> . |
1. *L. [Cribrilina] vulnerata* (Brydone), 1914, Geol. Mag. dec. vi. vol. i. p. 97, pl. iv. figs. 3–4; *mucronatus*-zone; Trimmingham, Weybourn, Norfolk.
2. *L. [Cribrilina] filiozati* (Brydone), 1910, Geol. Mag. dec. v. vol. vii. p. 391, pl. xxx. figs. 9–10; *quadratus*-zone; Hants.

3. *L. arcuata*, sp. n.

Type-specimen. British Museum, D. 28294; *quadratus*-zone; E. of Brighton, Sussex.

4. *L. languessensis*, sp. n.

Type-specimen. In collection of M. Canu (a photograph of type-specimen in British Museum); Campanian; Languesse, France.

5. *L. tenuilabrosa*, sp. n.

Type-specimen. British Museum, D. 28892; *Marsupites*-zone; Brighton, Sussex.

6. ? *L. [Reptoporella] regularis* (d'Orbigny), Pal. Franç. 1852, pl. 717. figs. 6-7, 1853, p. 475; Senonian; Sainte-Colombe, France. If this is a Lagynoporid, d'Orbigny's artist has drawn an œcium from the periphery of the asty, and repeated it, thus causing the distal communication-pore to appear in those inner œcia in which it naturally would be hid.

7. *L. magna*, sp. n.

Type-specimen. British Museum, D. 19623; *mucronatus*-zone; Lüneburg, Hanover.

D. *Rhacheoporidae*, fam. nov.

Multiserial Cheilostome Polyzoa of fair size (about $\frac{2}{3}$ mm.), with the intraterminal front wall formed of flattened costæ which are firmly fused in a narrow projecting median seam but have no intercostal fusions; apertural spines 4; secondary interœcial tissue tends to be developed; the apertural bar has a median process; there is a tendency to form a secondary aperture of which the proximal shield is formed (1) by the whole apertural bar alone, or (2) by the fusion of the apertural bar with the proximal pair of apertural spines, or (3) by a pair of avicularia lying proximally and laterally with regard to the aperture; avicularia small and numerous.

Tabular Diagnosis of the Subfamilies.

- | | | |
|---|--|----------------------------|
| A. Œcia comparatively delicate; avicularia, if definite in position, lie outside the apertural ring | | a. <i>Rhacheoporinae</i> . |
| B. Œcia comparatively coarse; avicularia tubular, a pair involved in the apertural ring | | b. <i>Disheloporinae</i> . |
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a. *RHACHEOPORINÆ*, subfam. nov.*Tabular Diagnoses of the Genera.*

- A. Secondary aperture absent, or, if present, is confined to certain cecia only (presumably involved in the formation of an ovicell), and the proximal shield is formed of the apertural bar only.
- I. No secondary aperture; all cecia alike.
- a. Ends of the costæ form a simple median seam 1. *Rhacheopora*.
- b. Ends of the costæ form two or more rows of minute solid tubercles in median area of fusion II. *Hystricopora*.
- II. Certain cecia only (presumably bearing ovicells) have a secondary aperture whose proximal shield consists of the apertural bar only and whose distal shield is formed of secondary tissue which swamps the apertural spines III. *Prosotopora*.
- B. A secondary aperture always present in all cecia.
- I. Secondary aperture with a proximal shield formed by the fusion of the proximal pair of apertural spines with a median process of the apertural bar IV. *Diancopora*.
- II. Secondary aperture formed entirely by the fusion of avicularia, which, growing up, replace the apertural spines V. *Diceratopora*.

I. *RHACHEOPORA*, gen. nov.Genotype. *R. suta*.*Tabular Diagnoses of the Species.*

- A. Larger (more than $\frac{2}{3}$ mm. long); avicularia somewhat pointed and tend to be directed towards the middle line of the cecium.
- I. Less secondary interœcial tissue; erect, uniserial.
- a. Costæ 26-28; about one avicularium to each aperture 1. *R. obliqua*.
- b. Costæ 30 or more; generally two avicularia to each aperture 3. *R. larvalis*.
- II. More secondary tissue.
- a. Erect, unilaminar 3. *R. bidens*.
- b. Erect, bilaminar 4. *R. incrassata*.
- B. Smaller ($\frac{2}{3}$ mm. or less in length); avicularia blunter and tend to be directed upwards and away from the middle line of the cecium.
- I. Less secondary tissue; incrusting, unilaminar. 5. *R. vallata*.
- II. More secondary tissue; erect, cylindrical ... 6. *R. suta*.
1. *R. [Semiescharipora] obliqua* (d'Orbigny), Pal. Franç. 1852, pl. 717. figs. 12-15, 1853, p. 481; Senonian; Fécamp, France.

2. *R. larvalis*, sp. n.

Type-specimen. British Museum, D. 23466; Coniacian; Fécamp, France.

3. *R. bidens*, sp. n.

Type-specimen. British Museum, D. 28539; Lower Senonian; Chatham, Kent.

4. ? *R. [Escharipora] incrassata* (d'Orbigny), Pal. Franç. 1851, pl. 685. figs. 1-4, 1852, p. 223; Senonian; Meudon, France.

5. *R. vallata*, sp. n.

Type-specimen. British Museum, D. 28302; *cortestudinarium*-zone; Lewes, Sussex.

6. *R. suta*, sp. n.

Type-specimen. British Museum, D. 4225; Lower Senonian; Chatham, Kent.

II. *HYSTRICOPORA*, gen. nov.

Genotype. *H. horrida*, sp. n. *Type-specimen*. British Museum, D. 28460; Coniacian; Fécamp, France.

III. *PROSOTOPORA*, gen. nov.

Genotype. *P. arrecta*.

Tabular Diagnoses of the Species.

- | | |
|---|-------------------------|
| A. Very many costæ—about 40 | 1. <i>P. neptuni</i> . |
| B. Larger (nearly 1 mm. long), more costæ (about 32); secondary aperture much lower; avicularia not so arrect; erect, unlaminar | 2. <i>P. bicornis</i> . |
| C. Smaller (about $\frac{3}{4}$ mm. long), fewer costæ (about 22); secondary aperture much higher; avicularia more arrect; erect, cylindrical | 3. <i>P. arrecta</i> . |

1. *P. [Eschara, Escharipora] neptuni* (d'Orbigny), 1859, Prod. Pal. vol. ii. p. 264; Senonian; Tours. Interpreted according to d'Orbigny, 1851, Pal. Franç. pls. 603. figs. 7-9, 684, fig. 12, 1852, p. 221; Senonian; Royan.

2. *P. bicornis*, sp. n.

Type-specimen. British Museum, D. 24388; *cortestudinarium*-zone; Luton, S.E. of Chatham, Kent.

3. *P. arrecta*, sp. n.

Type-specimen. British Museum, D. 8134; *coranguinum*-zone; Gillingham, N.E. of Chatham, Kent.

IV. DIANCOPORA, gen. nov.

Genotype. *D. ancora*, sp. n. *Type-specimen.* British Museum, D. 4035; Lower Senonian; Chatham, Kent.

V. DICERATOPORA, gen. nov.

Genotype. *D. bivia*, sp. n. *Type-specimen.* British Museum, D. 24534; *coranguinum*-zone; Gillingham, N.E. of Chatham, Kent.

b. *DISHELOPORINÆ*, subfam. nov.*Tabular Diagnoses of the Genera.*

- | | |
|--|-------------------------|
| A. Intraterminal front wall more arched; less secondary tissue; no secondary aperture..... | I. <i>Dishelopora</i> . |
| B. Intraterminal front wall flatter; much secondary interæcial tissue; a secondary aperture formed by a general prolongation of the apertural bar as a proximal shield | II. <i>Geisopora</i> . |

I. DISHELOPORA, gen. nov.

Genotype. *D. bicuspis*.

Tabular Diagnoses of the Species.

- | | |
|---|-----------------------------|
| A. Apertural bar not specially differentiated; length about $\frac{2}{3}$ mm. | |
| I. Costæ 20-30; unilaminar, incrusting..... | 1. <i>D. cuckmerensis</i> . |
| II. Costæ 16-20; unilaminar, incrusting | 2. <i>D. bispinosa</i> . |
| B. Apertural bar with broad median process; costæ 16-20; length $\frac{1}{2}$ - $\frac{2}{3}$ mm.; unilaminar, incrusting | 3. <i>D. valvata</i> . |
| C. Apertural bar with narrow median projection; unilaminar, incrusting. | |
| I. Costæ 10-15; length about $\frac{2}{3}$ mm. | 4. <i>D. claviceps</i> . |
| II. Costæ 16-20; length nearly 1 mm. | 5. <i>D. bicuspis</i> . |
| D. Apertural bar much flattened and proximally bent, with no obvious spine or crest; costæ 12-16 or more; unilaminar, incrusting. | |
| I. Length about $\frac{2}{3}$ mm. | 6. <i>D. binoculata</i> . |
| II. Length about 1 mm. | 7. <i>D. biforis</i> . |

1. *D. cuckmerensis*, sp. n.

Type-specimen. British Museum, D. 28298; *cortestudinarium*-zone; Cuckmere Haven, Sussex.

2. *D. bispinosa*, sp. n.

Type-specimen. British Museum, D. 28922; low in *coranguinum*-zone; Hindover, N.E. of Seaford, Sussex.

3. *D. valvata*, sp. n.

Type-specimen. British Museum, D. 4964; Lower Senonian; Chatham, Kent.

4. *D. [Cribrilina] claviceps* (Brydone), 1910, Geol. Mag. dec. v. vol. vii. p. 390, pl. xxx. figs. 2-5; Senonian; England. Interpreted according to specimens from the *coranguinum*-zone, in the collection of Mr. G. E. Dibley, and identified by Mr. Brydone as this species.

5. *D. bicuspis*, sp. n.

Type-specimen. British Museum, D. 21202; *coranguinum*-zone; Wooburn Green, Bucks.

6. *D. binoculata*, sp. n.

Type-specimen. British Museum, D. 8167; *coranguinum*-zone; Gillingham, N.E. of Chatham, Kent.

7. *D. biforis*, sp. n.

Type-specimen. British Museum, D. 8362; *cortestudinarium*-zone; Luton, S.E. of Chatham, Kent.

II. *GEISOPORA*, gen. nov.

Genotype. *G. protecta*, sp. n. *Type-specimen*. British Museum, D. 15421; *mucronatus*-zone; Rügen, Germany.

E. *Otoporidæ*, fam. nov.

Multiserial Cheilostome Polyzoa in which the intra-terminal front wall consists of arched tapering spines that may be quite separated laterally, and merely overlapping those of the opposite side in the middle line, without fusion,

or with slight fusion, or may be firmly fused medianly, and touching, but not fused laterally; an apertural bar is either not formed or imperfectly formed (that is, the spines of which it is formed overlap and the subsequent fusion does not produce a bilaterally symmetrical structure); extraterminal front wall always visible and often considerably developed, especially proximally; apertural spines, if present, four, never much enlarged; a secondary aperture never formed; avicularia paired and generally pointed, primitively not large, narrow and straight, secondarily larger, wider, and curved towards the aperture, finally absent; ovicells with a median keel or seam and, consequently, an aperture somewhat mucronately pointed above.

Tabular Diagnoses of the Genera and Species.

- | | |
|---|---------------------------------|
| A. Costæ separate, not fused in the middle line, or very slightly so. | |
| 1. Avicularia present; first pair of costæ not larger than the rest | I. ANAPTOPORA. |
| <i>a.</i> Avicularia large and pointed. | |
| 1. Incrusting, unilaminar | 1. <i>A. disjuncta</i> . |
| 2. Erect, cylindrical | 2. <i>A. cantabridgensis</i> . |
| <i>b.</i> Avicularia tend to dwindle and become blunt; erect, cylindrical | 3. <i>A. möckleri</i> . |
| II. Avicularia absent; first pair of costæ larger than the rest and are not curved. | II. ANOTOPORA <i>inaurita</i> . |
| B. Costæ firmly fused in the middle line, and laterally adjacent, but not fused .. | III. OTOPORA <i>auricula</i> . |

I. ANAPTOPORA, gen. nov.

Genotype. *A. disjuncta*.

1. *A. disjuncta*, sp. n.

Type-specimen. British Museum, D. 23269; Cenomanian; Chalk Marl; Cambridge.

2. *A. cantabridgensis*, sp. n.

Type-specimen. British Museum, D. 21788; Cenomanian, Chalk Marl; Cambridge.

3. *A. möckleri*, sp. n.

Type-specimen. British Museum, D. 21853; Cenomanian, Chalk Marl; Cambridge.

II. ANOTOPORA, gen. nov.

Genotype. *A. inaurita*, sp. n. *Type-specimen*. British Museum, D. 21789; Cenomanian, Chalk Marl; Cambridge.

III. OTOPORA, gen. nov.

Genotype. *O. auricula*, sp. n. *Type-specimen*. British Museum, D. 23044; Cenomanian, Chalk Marl; Cambridge.

F. Ctenoporidae, fam. nov.

Multiserial Cheilostome Polyzoa with uniserial early stages whose intraterminal front wall is furnished with very thin cylindrical costae, arched over and hardly fused or very slightly fused in the middle line and with no lateral fusions, but the costae are firmly fused beneath to a ground-tissue that forms a solid arched intraterminal front wall; apertural bar imperfectly formed (that is, the two costae of which it is composed overlap and the subsequent fusion does not hide this to form a bilaterally symmetrical apertural bar); apertural spines small, four in number; avicularia generally a pair to each aperture, small and blunt; no secondary interoecial tissue or secondary apertures.

CTENOPORA, gen. nov.

Genotype, *C. pecten*, sp. n. *Type-specimen*. British Museum, D. 21691; Cenomanian, Chalk Marl; Cambridge.

G. Calpidoporidae, fam. nov.

Multiserial Cheilostome Polyzoa of fair size (about $\frac{3}{4}$ mm. in length), of which the intraterminal front wall is not much arched and is composed of stout, flattish, parallel-sided costae of unequal thickness, widely separate laterally but firmly fused in the middle line; the apertural bar has a median projection, which may be flattened into a proximal shield; there is much interoecial secondary tissue; avicularia small to moderate-sized, more or less pointed.

Tabular Diagnoses of the Genera.

A. Median area of fusion comparatively narrow; avicularia sharp.

I. Avicularia paired, situated laterally rather than proximally with regard to the aperture. I. *Calpidopora*.

- II. Avicularia sporadic or, if paired, situated proximally rather than laterally with regard to the aperture II. *Rhabdopora*.
 B. Median area of fusion comparatively broad; avicularia comparatively blunt III. *Graptopora*.

I. CALPIDOPORA, gen. nov.

Genotype. *C. diota*.

Tabular Diagnoses of the Species.

- A. Apertural bar with unflattened median projection.
 I. Avicularia minute, straight.
 a. Incrusting, unilaminar.
 1. Avicularia, more than one pair to each aperture 1. *C. subfallax*.
 2. Avicularia, a pair only to each aperture .. 2. *C. novaki*.
 b. Erect, bilaminar 3. *C. mumia*.
 II. Avicularia larger, slightly curved; erect, unilaminar 4. *C. diota*.
 B. Apertural bar flattened to form a proximal shield.
 I. Proximal shield narrow; avicularia larger than (A), but still small, curved, and pointed; erect, bilaminar 5. *C. auritulus*.
 II. Proximal shield broader; avicularia larger, curved, and pointed; erect, unilaminar 6. *C. aurita*.
1. *C. [Membraniporella] subfallax* (Lecointre), 1912, Bull. Soc. Géol. France, series iv. vol. xii. p. 354, pl. xiv. fig. 5; Cenomanian; Le Mans, France.

2. *C. novaki*, sp. n.

Type-specimen. British Museum, D. 28508; Cenomanian; Korycaner Schichten; Kank, Bohemia.

3. *C. [Eschara] mumia* (Pocta), 1892, Mech. Kory. Kank. Kut. Hor.; Cesk. Acad. Cis. Frant. Josefa, p. 32, pl. iv. figs. 10–11; Cenomanian, Korycaner Schichten; Kank, Bohemia.

4. *C. diota*, sp. n.

Type-specimen. British Museum, D. 28509; Cenomanian; Korycaner Schichten; Kank, Bohemia.

5. *C. auritulus*, sp. n.

Type-specimen. British Museum, D. 28513; Cenomanian; Korycaner Schichten; Kank, Bohemia.

6. *C. aurita*, sp. n.

Type-specimen. British Museum, D. 28511 ; Cenomanian ; Korycaner Schichten ; Kank, Bohemia.

II. RHABDOPORA, gen. nov.

Genotype. *R. virgata*.

Tabular Diagnoses of the Species.

A. Incrusting, unilaminar	1. <i>R. virgata</i> .
B. Erect, unilaminar	2. <i>R. virgulata</i> .
C. Erect, bilaminar	3. <i>R. tigrina</i> .

1. *R. virgata*, sp. n.

Type-specimen. British Museum, D. 28429 ; Turonian ; N.E. of Chartre-sur-Loir, France.

2. *R. virgulata*, sp. n.

Type-specimen. British Museum, D. 28431 ; Upper Turonian ; N.E. of Chartre-sur-Loir, France.

3. *R. tigrina*, sp. n.

Type-specimen. British Museum, D. 28425 ; Turonian ; N.E. of Chartre-sur-Loir, France.

III. GRAPTOPORA, gen. nov.

Genotype. *G. scripta*.

Tabular Diagnoses of the Species.

A. Œcia very long, about three times as long as broad ; erect, unilaminar	1. <i>G. semicostata</i> .
B. Œcia little more than twice as long as broad.	
I. Œcia fairly parallel-sided ; unilaminar	2. <i>G. scripta</i> .
II. Œcia fusiform ; erect, bilaminar	3. <i>G. raripora</i> .

1. *G. [Semiescharipora] semicostata* (d'Orbigny), Pal. Franç. 1852, pl. 719. figs. 1-4, 1853, p. 486 ; Senonian ; Tours, France.

2. *G. scripta*, sp. n.

Type-specimen. British Museum, D. 27750 ; Santonian ; Coulommiers, France.

3. *G. [Escharipora] raripora* (d'Orbigny), 1852, Pal. Franç. p. 234, pl. 703. figs. 16–18; Senonian; near Tours, France.

H. Myagroporidæ, fam. nov.

Multiserial Cheilostome Polyzoa of fair size ($\frac{1}{2}$ – $\frac{3}{4}$ mm. in length), exhibiting a great development of interœcial secondary tissue with a very primitive intraterminal front wall; the latter consists of thin, cylindrical, pointed costæ, widely separate laterally and very slightly or hardly fused medianly; the apertural bar is imperfect; the apertural spines are four in number, the proximal pair as large as the costæ and directed straight upwards; avicularia tubular, rising above the interœcial tissue and sporadic, but a pair generally lie side by side in the space distal to one œcium and proximal to the next (really the area directly over the proximal part of the extraterminal front wall which has been swamped by secondary tissue); apertures of avicularia blunt and slightly constricted, directed away from the median line of the œcium to which they may be referred, and obliquely upwards.

MYAGROPORA, gen. nov.

Genotype. *M. muscipula*.

Tabular Diagnoses of the Species.

- | | |
|--|--------------------------|
| A. Incrusting or erect, unilaminar; œcia small,
about $\frac{1}{2}$ mm..... | 1. <i>M. cavea</i> . |
| B. Erect, cylindrical; œcia larger, about $\frac{2}{3}$ mm. .. | 2. <i>M. muscipula</i> . |

1. *M. cavea*, sp. n.

Type-specimen. British Museum, D. 25543; low in *cor-testudinarium*-zone; S.E. of Boxmoor, Herts.

2. *M. muscipula*, sp. n.

Type-specimen. British Museum, D. 25501; low in *cor-testudinarium*-zone; S.E. of Boxmoor, Herts.

I. Taractoporidæ, fam. nov.

Multiserial Cheilostome Polyzoa of very variable size, of which the intraterminal front wall is composed of few, flat, wide, but rapidly tapering costæ, widely separate laterally, but firmly fused in a thin median line of fusion; apertural

bar very thick, with a median projection; apertural spines four; secondary interœcial tissue much developed; avicularia numerous, sporadic, small, blunt, and with constricted apertures, growing up with the interœcial secondary tissue and tending to swamp the intraterminal front wall by forming an incomplete secondary front wall.

TARACTOPORA, gen. nov.

Genotype. *T. confusa*.

Tabular Diagnoses of the Species.

A. Costæ about 6.

I. Avicularia smaller and less secondary tissue . . . 1. *T. confusa*.

II. Avicularia larger and more secondary tissue . . . 2. *T. obscurata*.

B. Costæ 8-10; avicularia small and much secondary tissue 3. *T. rostrata*.

1. *T. confusa*, sp. n.

Type-specimen. British Museum, D. 25538; low in *cor-testudinarium*-zone; S.E. of Boxmoor, Herts.

2. *T. [Membraniporella] obscurata* (Brydone), 1916, Geol. Mag. dec. vi. vol. iii. p. 99, pl. vi. figs. 9-10; *cor-testudinarium*-zone; Seaford, Sussex.

3. *T. rostrata*, sp. n.

Type-specimen. In the collection of M. Canu (a photograph of the type-specimen in British Museum); Coniacian; Fécamp, France.

J. Thoracoporidae, fam. nov.

Multiserial Cheilostome Polyzoa of small to moderate size ($\frac{1}{3}$ - $\frac{2}{3}$ mm. in length) derived from "Membranimorphs" with ovate apertures; the intraterminal front wall is formed of few, thin, cylindrical, well-arched costæ, widely separate laterally and hardly fused or firmly joined in a thin median line of fusion; apertural spines four, the proximal pair as large as the costæ; little or no secondary tissue developed; avicularia fairly large, sporadic, with long spatulate mandibles, in general shape resembling the avicularia of the Eleidae (eleocellaria of Canu, 1900, Bull. Soc. Géol. France, ser. iii. vol. xxviii. p. 341).

THORACOPORA, gen. nov.

Genotype. *T. costata*.*Tabular Diagnoses of the Species.*

- A. Larger, about $\frac{2}{3}$ mm.; avicularia larger; costæ very slightly fused or not fused medianly 1. *T. raptrix*.
 B. Smaller, about $\frac{1}{3}$ – $\frac{1}{2}$ mm.
 I. Avicularia smaller, hardly spatulate 2. *T. pontifera*.
 II. Avicularia larger, spatulate 3. *T. costata*.

1. *T. raptrix*, sp. n.

Type-specimen. British Museum, D. 11135; Lower Senonian; Chatham, Kent.

2. *T. [Membraniporella] pontifera* (Brydone), 1916, Geol. Mag. dec. vi. vol. iii. p. 99, pl. vi. fig. 8; *coranguinum*-zone; Gravesend, Kent.

3. *T. costata*, sp. n.

Type-specimen. British Museum, D. 24406; *coranguinum*-zone; Luton, S.E. of Chatham, Kent.

Indeterminable Described Forms.

- A. Described by d'Orbigny, 1851–3, Pal. Franç., Ter. Cret. vol. v. :—

1. *Escharella arge*, 1851, pl. 666. figs. 7–9, 1852, p. 219; Senonian; Royan.
2. *Semiescharipora complanata*, 1852, pl. 718. figs. 17–20, 1853, p. 484; Senonian; Vendôme.
3. *Reptescharella costata*, 1852, pl. 716. figs. 16–18, 1853, p. 470; Senonian; Tours.
4. *Repteschariopora exigua*, 1852, pl. 719. figs. 20–22, 1853, p. 491; Senonian; Meudon.
5. *Disteginopora francqana*, 1852, pl. 734. figs. 9–11, 1853, p. 498; Senonian; Meudon.
6. *Reptescharella inæqualis*, 1852, pl. 716. figs. 1–3, 1853, p. 467; Senonian; France.
7. *Escharipora inornata*, 1851, pl. 686. figs. 17–19, 1852, p. 230; Senonian; Sainte-Colombe.
8. *Semiescharipora irregularis*, 1852, pl. 719. figs. 9–12, 1853, p. 487; Senonian; Saintes, Pons.
9. *Steginopora irregularis*, 1852, pl. 720. figs. 16–19, 1853, p. 500; Senonian; Saintes.

10. *Escharina lorieri*, 1851, pl. 604. figs. 11-12, *Reptescharella lorieri*, 1853, p. 466; Cenomanian; Le Mans.
11. *Reptescharipora meudonensis*, 1852, pl. 719. figs. 17-19, 1853, p. 491; Senonian; Meudon.
12. *Semiescharipora mumia*, 1852, pl. 718. figs. 9-12, 1853, p. 483; Senonian; Sainte-Colombe.
13. *Escharipora ovalis*, 1852, p. 233, pl. 703. figs. 13-15; Senonian; Tours.
14. *Reptescharella ovula*, 1852, pl. 715. figs. 17-19, 1853, p. 466; Cenomanian; N. of Tourtenay.
15. *Escharipora plana*, 1851, pl. 685. figs. 17-19, 1852, p. 226; Senonian; Vendôme.
16. *Escharipora prolifica*, 1851, pl. 685. figs. 13-16, 1852, p. 225; Senonian; near Sainte-Colombe.
17. *Steginopora pulchella*, 1852, pl. 721. figs. 9-12, 1853, p. 503; Senonian; Vendôme.
18. *Reptescharipora punctata*, 1852, pl. 720. figs. 4-5, 1853, p. 493; Senonian; Tours.
19. *Escharella ramosa*, 1851, pl. 684. figs. 9-11, 1852, p. 220; Senonian; Meudon.
20. *Escharipora regularis*, 1851, pl. 685. figs. 9-12, 1852, p. 224; Senonian; Sainte-Colombe.
21. *Reptescharipora rustica*, 1852, pl. 720. figs. 9-10, 1853, p. 494; Senonian; Royan.
22. *Semiescharipora simplex*, 1852, pl. 718. figs. 1-4, 1853, p. 481; Senonian; Fécamp.

B. Described by Brydone, 1909-10, Geol. Mag. dec. v. vols. vi. & vii. :—

23. *Membraniporella fallax*, 1910, p. 482, pl. xxxvi. figs. 6-8; *Marsupites*- and *coranguinum*-zones; Hants and Kent.
24. *Steginopora gravensis*, 1910, p. 481, pl. xxxi. figs. 4-5; *coranguinum*-zone; Gravesend.
25. *Membraniporella monastica*, 1909, p. 398, pl. xxii. figs. 1-3; *mucronatus*-zone; Trimmingham.

C. Described by Hennig, 1892, Lunds Univ. Årsskr. vol. xxviii. no. xi. :—

26. *Membraniporella juvenis*, p. 39, pl. ii. figs. 36-37; Upper Senonian; Sweden.
27. *Cribrilina lævis*, p. 37, pl. ii. figs. 29-30; Upper Senonian; Sweden.
28. *Cribrilina quadrisulcata*, p. 38, pl. ii. figs. 31-32; Danian; Annetorp, Sweden.

D. Described by von Hagenow, 1851, Bry. Maastr. Kreid. :—

29. *Eschara edwardsiana*, p. 70, pl. viii. fig. 12; Maastrichtian; Maastricht.
30. *Cellepora (Escharina) lessoni*, p. 89, pl. x. fig. 10; Maastrichtian; Maastricht.

E. Described by Reuss, 1872, *Palaeontographica*, vol. xx. part i. :—

31. *Eschara pupoides*, p. 107, pl. xxvi. fig. 5; Cenomanian; Saxony.
32. *Lepralia undata*, p. 104, pl. xxv. fig. 5; Cenomanian; Saxony.

F. Described in various works :—

33. *Cribrilina collaris*, Marsson, 1887, *Pal. Abh.* vol. iv. part 1, p. 98, pl. x. fig. 10; *mucronatus*-zone; Rügen.
34. *Cribrilina falcoburgensis*, Pergens, 1894, *Bull. Soc. belge Géol.* vol. vii. *Mém.* p. 188, text-fig. 7 on p. 188; Maastrichtian; Fauquemont.
35. *Escharipora immersa*, Gabb & Horn, 1862, *Journ. Acad. Nat. Sci. Philadelphia*, series 2, vol. v. p. 149; Danian; New Jersey.
36. *Cellepora incisa*, Hagenow, 1839, *Neues Jahrbuch Min.* p. 275, pl. iv. fig. 11; *mucronatus*-zone; Rügen.
37. *Cribrilina nitidiformis*, Vine, 1893, *Brit. Assoc. Rep. for 1892*, pp. 316, 336; Lower Senonian; Chatham.
38. *Escharoides peltata*, Römer, 1840, *Verst. Norddeutsch. Kreidegeb.* p. 14, pl. v. fig. 7; Senonian; Peine.
39. *Cellepora prona*, Stoliczka, 1872, *Pal. Indica*, series viii. vol. iv. no. 2, p. 12, pl. i. fig. 1; Arriallor Group; Poodoopoliham.
40. *Cellepora scutigera*, Reuss, 1854, *Denk. k. Acad. Wiss. Wien*, vol. vii. p. 135, pl. xxvii. fig. 6; Turonian; Nefgrab.

The author hopes to be able in the future to expand the above revision, with its terse tabular diagnoses, into a volume of the 'British Museum Catalogue of Cretaceous Bryozoa.'

XLVII.—*Note on a new Baboon* (*Simopithecus oswaldi*, *gen. et sp. n.*) from the (?) *Pliocene of British East Africa*.
By C. W. ANDREWS, D.Sc., F.R.S. (British Museum, Natural History).

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[Plate XV.]

ON his return journey from Karungu Dr. Felix Oswald* visited Homa Mountain, near the eastern shores of the Victoria Nyanza—a locality in which mammalian remains had been previously collected by Mr. Milliken. In addition to the remains of the elephant already known, he obtained

* 'Geographical Journal,' vol. xli. (1913) p. 114; also *Quart. Journ. Geol. Soc.* vol. lxx. (1914) p. 128.

numerous bones and teeth of Antelopes, *Phacochærus*, and *Hippopotamus*, together with portions of the skull, mandible, and limb-bones of the large baboon which forms the subject of the present paper. The bones were found in a greenish-grey sandstone exposed in a low cliff near the lake-shore west of the Awach River; the age of the bed is doubtful, but probably it was late Pliocene or early Pleistocene.

PRIMATES.

Family Cercopithecidæ.

Among the more important specimens in Dr. Oswald's collection are the numerous remains of a large baboon, which present a number of peculiar characters. The principal pieces are:—(1) the facial portion of a female skull, the region behind the lower part of the orbits and the greater part of the premaxillæ being wanting; (2) a mandible, probably belonging to the same individual, wanting the right ramus behind the second molar and the angular region of the left ramus. These two specimens form the basis for the description given below. In addition to these there are a right maxilla with the molars in excellent preservation, a portion of a left mandibular ramus with pm_4-m_3 , part of a smaller right mandibular ramus with pm_3-m_2 , and the posterior portion of a left ramus showing the condyle and angle. There are also several odd teeth, including the lower canines of an old male. Altogether, the parts of the skull and mandible preserved indicate the presence of at least four individuals.

The other portions of the skeleton represented are portions of humeri, radii, ulnæ, ossa innominata, femora, the astragalus, calcaneum, and cuboid; these belong to several individuals, differing considerably in size. All the remains are highly mineralized and in a beautiful state of preservation; in nearly all cases they terminate in fresh fractures, showing that further collecting would probably yield more complete material.

Skull (Pl. XV. figs. 1 & 2).—The most important specimen is the facial portion of a skull, which, from the small size of the canine, is clearly that of a female. The whole of the cranial portion is wanting, the fracture occurring at about the middle of the orbits, only the lower portions of which are preserved; the base of the jugal region of the zygomatic arch is preserved on both sides, but is most nearly complete on the right. The nasals are wanting, as also are the tooth-bearing portions of the premaxillæ. The only other portion

of the skull preserved is an imperfect right maxilla (fig. 3) of a rather younger individual with the true molars in an excellent state of preservation.

The portion of the face beneath the orbits is short and considerably deeper than in *Papio*, *Theropithecus*, and in the female *Macacus*, the skulls most nearly resembling the fossil in this respect being those of males of *Macacus* and *Cercocebus*; this deepening of the face is consequent upon the large size of the maxillæ, which, again, seems to be correlated with the relatively large size of the cheek-teeth. The outer face of the maxilla is, on the whole, gently convex from above downwards, there being only a very slight concavity on the side of the face in front of the base of the zygomatic arch, as in *Macacus*. In the type-specimen of *Papio subhimalayanus*, Meyer, sp., this depression is likewise wanting, but here the depth of the maxillary region is much less. In *Papio* and *Theropithecus* this depression is well developed, and in the males may form a sharply defined fossa.

The *nasals* are entirely wanting, but it can be seen that they were small and that possibly the maxillæ met in the middle line above them; it is not possible to be certain what were their relations to the facial processes of the premaxillæ, which are the only portions of those bones remaining. These processes are short and probably only just overlapped the lower ends of the nasals, a condition resembling that seen in *Theropithecus*. In *Papio*, *Macacus*, and *Cercocebus*, on the other hand, the posterior ends of the premaxillæ extend considerably between the nasals and maxillæ behind the level of the posterior border of the narial opening.

The facial suture between the maxilla and jugal commences at about the inner third of the lower border of the orbits, and runs outwards and downwards on to the base of the zygomatic process, the lower edge of which is in part formed by the maxilla. The anterior face of the jugal, which is relatively large and massive, is gently convex; it looks more directly forwards and less upwards, and stands out farther than in *Papio* or, to a less degree, *Macacus*, in this last respect even surpassing *Theropithecus*, where also it is very prominent. The nearly vertical position of the jugal is correlated with the shortness of the face, the backward slope being especially marked in the long-snouted *Papio*. One consequence of this backward slope is that in *Papio* the orbit lies considerably behind the level of the last molar; in *Macacus* the lower border of the orbit is over m_2 , while in the present specimen it is about over the anterior lobe of m_3 .

Probably, however, the precise relative position with regard to the teeth varies considerably with age and sex.

There are two small facial foramina about 5 mm. apart on the suture between the maxilla and jugal; the upper opening is about 1.5 cm. beneath the orbit; in other ape skulls examined these openings do not occur on the suture, but perforate the maxilla.

The palate is strongly concave from side to side, and the slit-like posterior palatine foramina are on the maxillo-palatine suture at about the level of the posterior lobe of m_3 .

The Upper Teeth (Pl. XV. figs. 2 & 3).—In the skull above described the tooth-series from the canine to the last molar is well preserved on the right side, while on the left pm_3 is missing; the premolars and first molar are in an advanced state of wear, the pattern of the crowns being obliterated. A second specimen of the right maxilla (fig. 3) has m_1-m_3 well preserved and in a much less advanced state of wear, the posterior columns of m_3 being still intact.

The upper molars in their general structure are very similar to those of the recent baboons (*Papio*, *Theropithecus*), but differ in their relatively larger size, and especially in their greater length in proportion to their width; in the last character they resemble the molars of *Theropithecus* most nearly. The intermediate cusps are well developed, so that in wear the inner tubercles show a well-marked trefoil pattern. There is a well-developed cingulum on the front and back of the molars. The upper premolars present no special peculiarities, while the canine is small and projects little below the premolars, showing that the individual was a female. The form of the crown of the canine is almost identical with that seen in a female specimen of *Theropithecus gelada*.

The dimensions of the skull (in millimetres) are:—

Width at outer ends of base of zygomatic process	110
Depth of face from orbit to alveolar border	45
Width of palate between the first molars	28

The dimensions of the upper teeth (in millimetres) are:—

	Length.	Width.
m_3	15.5	13
m_2	15	13
m_1	12	11
pm_4	7	10
pm_3	7	8
c	8	7

The measurements in m_1-pm_3 are taken on the surface of
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wear. The length of the molar series taken together is 43 mm.

Mandible (Pl. XV, fig. 4).—The mandible is very massively constructed, probably in correlation with the large size of the teeth. The symphysis is deep; its upper surface between the incisors, canines, and third premolars is only slightly concave from side to side, and slopes gently downwards and backwards till, at about the level of pm_4 , it turns suddenly downwards to the deep geniohyal fossa. The shallowness and length of this upper part of the symphysis seem to be exceptional. In *Papio*, where also it is not very deeply concave from side to side, it terminates about the level of the back of pm_3 ; in *Theropithecus* this region is much more deeply concave and slopes more steeply downwards; in *Macacus* it is altogether shorter. In *Papio falconeri*, Lydekker, sp., from the Pliocene of the Siwalik Hills, the mandible is massive and deep, as in the present species; but even in this case the symphysis is shorter, and at the same time the teeth are relatively smaller. The outer face of the horizontal ramus beneath the premolars and first molar is nearly flat, showing little trace of the concavity seen in this position in *Papio* and *Theropithecus*, especially in the males. In *Macacus* the depression is less marked, especially in the females, and in the so-called *Papio falconeri* it is much as in the present specimen. The anterior border of the ascending ramus is straight or even slightly concave; in the other apes with which comparison has been made it is convex at least in its upper portion; this nearly straight anterior border is inclined considerably backwards. The coronoid process rises above the condyle; it is larger and more prominent than in *Macacus* and *Theropithecus*, and is thickened at its upper end. The condyle is wider from side to side than in *Macacus* and *Papio*, in this respect resembling that of *Theropithecus*; the greater width is accounted for by the considerable degree to which it projects on the inner side. In the type-specimen there is on the outer face of the ascending ramus, a little beneath the base of the coronoid process, a well-marked prominence, perforated below by a foramen which I have not seen in any other ape mandible. In the female mandible the outer face of the ascending ramus is only slightly concave in front of the ridge running down from the condyle, much as in *Macacus*, while in another jaw, probably of a male, this concavity is a little more marked, but less so than in the female *Theropithecus*; in the males of *Papio* and *Theropithecus* this depression is strongly developed. The angle of the jaw is not preserved in the

mandible above described, but in another specimen it is seen to be rounded, with a slightly inflexed margin. The dental foramen is in the position usual in the family.

Lower Molars (Pl. XV. figs. 4 & 5).—In the figured mandible the incisors and canines are represented by their broken bases only. The canines (*c.*) are oval in section and are small, showing that the individual was a female. The anterior premolar (pm_3) is likewise small, but its anterior face is enlarged and produced downwards and forwards to receive the bite of the posterior edge of the upper canine, as is usual in this group. The remaining teeth, though proportionately larger, are similar to those of *Theropithecus*, the intermediate cusps being well developed and there being an even larger talon in m_3 . This talon consists of a large cusp and a raised border with well-marked crenulations connecting it with the postero-internal cusp; in *Papio* and *Macacus* the talon is proportionately much smaller.

The dimensions of the mandible of the type-specimen (in millimetres) are :—

Length of symphysis	46
Length from incisive border to back of condyle	130
Width of ascending ramus at condyle	48
Depth of horizontal ramus beneath m_1	33
" " " " m_3	31

The dimensions of the teeth (in millimetres) are :—

	Length.	Width.
pm_3	10	7
pm_1	9	8
m_1	11	?
m_2	14	?
m_3	20	11

The collection also includes a pair of very large lower canines (Pl. XV. fig. 6), presumably of an old male. That of the right side has lost most of its crown, but the left is nearly complete, only the tip of the root being lost. The root is very massive and oval in section, the long axis being antero-posterior; on the inner face there is a slight longitudinal groove. The crown is greatly worn on its posterior face, the surface of wear terminating below in a sharp oblique step. This condition is almost exactly similar to that seen in an old male *Theropithecus*, but here the tooth as a whole is much more slender. The length of the left tooth (so far as preserved) is about 46 mm., the width of its root from before backwards 17 mm., and that from side to side 11 mm.

From the comparisons given above, it will be seen that the present species differs in numerous points from the related living forms. In the case of the fossils also it has been shown to differ from the so-called *Papio subhimalayanus*, Meyer, sp., and from *Papio falconeri*, Lydekker, sp.*. In *Oreopithecus* of the Upper Miocene of Monte Bamboli the molars are considerably longer than wide, and Schlosser † remarks on their similarity to those of *Theropithecus gelada*, a species to which our fossil also approximates; but, at the same time, there are important differences. Thus, in *Oreopithecus* the last upper molar is nearly quadrate in outline instead of being much longer than wide, and, lastly, in the molars of *Oreopithecus* the intermediate tubercles and the anterior and posterior portions of the cingulum are much less developed. *Mesopithecus*, from the Upper Miocene of Pikermi, apart from its much smaller size, differs in many respects, especially in the more quadrate outline of its upper molars and the fact that the last upper molar is considerably smaller than the tooth in front; in the lower molars there is practically no anterior cingulum and the intermediate tubercles are scarcely at all developed.

Dolichopithecus, described by Depéret ‡ from the Middle Pliocene of Rousselon, differs in the smaller size and simpler character of the talon of the lower m_3 , the large size of the lower pm_3 , and the much shorter symphysis of the mandible, the horizontal ramus of which is nevertheless deep.

Libypithecus, described by Stromer § from the Middle Pliocene of the Wadi Natrun, differs widely in the relatively small size of the cheek-teeth, in the nearly quadrate outline of the molars, in which the anterior and posterior portions of the cingulum and the intermediate cusps are little developed. In fact, *Libypithecus*, *Dolichopithecus*, and *Mesopithecus* are all apparently much more nearly related to the Semnopithecinae than to the true baboons. *Aulaxinus*, described by Cocchi ||, seems to be identical with *Macacus*

* Lydekker, 'Siwalik Mammalia,' Supplement i. p. 6, pl. i. figs. 3, 3a (Palæont. Indica, ser. x. vol. iv., 1886).

† Schlosser, "Die Affen Lemuren etc. des europäischen Tertiärs," Beitr. Paläont. Österr.-Ung. Bd. vi. (1887) p. 16.

‡ Depéret, "Les Animaux pliocènes du Roussillon," p. 11, Mém. Soc. géol. France (Paléont.), mém. 3 (1890).

§ Stromer, "Mitteilungen über Wirbeltierreste aus dem Mittelpliocän des Natrontales (Ägypten)," Zeitschr. deutsch. geol. Gesellsch. Bd. 65 (1913-14), p. 350.

|| Cocchi, "Su di due Scimmie fossili italiane," Bol. R. Com. geol. Ital. vol. iii. (1872) p. 68.

(*Pithecus*). Remains of other extinct baboons are known, but in most cases are too imperfect for useful comparison.

On the whole, it may be asserted that the specimen now described represents a new generic type distinguished by (1) the shortness of the snout, (2) the relatively large size of the cheek-teeth, (3) the great length of the molars in proportion to their width.

The name *Simopithecus* is proposed for this genus, the name of the species being *S. oswaldi*. The female skull and lower jaw described above are to be taken as the type-specimens*.

This comparatively short-snouted form, with its powerful dentition, may, perhaps, have been the forerunner of the baboons with the elongate muzzles, and in many respects resembles the Gelada baboon (*Theropithecus gelada*) of Abyssinia, in which the prolongation of the face is less marked than in most species of *Papio*, especially in the males.

It is unfortunate that the limb-bones are nearly all incomplete, so that their proportions cannot be estimated with certainty. Some of the specimens show that some individuals of this species attained a very large size.

The *humerus* is represented by the distal end of a large specimen and the lower three-fourths of a smaller one, both from the left side. In the large specimen the flange on the ulnar side of the articulation is less produced than in the mandrill (*Papio sphinx*) and the male of *Theropithecus*. Otherwise it is very similar to that of the mandrill, especially in the strong development of the internal condyle. The width of the distal articulation in the fossil is 34 mm.; in a large mandrill with a humerus 222 mm. long the width is 33 mm.; in the male *Theropithecus* it is 23 mm. The form of the distal end of the smaller humerus is almost exactly as in the male *Theropithecus*, but, judging from the ridges on the shaft, the bone was considerably shorter and

* A brief account of a number of mammalian remains from Central Africa has lately been given by Hans Reck (Sitzungsb. Gesellsch. Naturforsch. Freunde Berlin, nos. 3 & 7, 1914). These specimens are from beds, probably of Pliocene age, exposed on the sides of a gorge cutting into the edge of the Serengeti Plateau at Oldoway (lat. 3° S., long. 35° 25' E.). Among the more important discoveries are two species of elephant, one apparently very similar to, if not identical with, that from Homa Mountain, a baboon which may be the same as that now described, a three-toed horse near *Hipparion*, and, lastly, a nearly complete human skeleton which Reck regarded as contemporary with the other remains, though this seems to be at least doubtful.

stouter; the deltoid crest is much less developed than in the mandrill.

The *radius* is represented by one complete specimen and the upper ends of two others, one of very large size. The complete bone has its shaft less compressed and with a more rounded anterior face than in the mandrill; the muscular ridges are less marked than in that animal, but, on the other hand, more so than in the male *Theropithecus*, in which, however, the bicipital tuberosity is more feebly developed. The bone, as a whole, is more slender than in the mandrill. Its dimensions (in millimetres) are:—

	Length.	Width of upper end.	Width of lower end.	Width of shaft.
<i>Simopithecus</i>	200	16	23	15
Mandrill.....	225	19	25	19
Male <i>Theropithecus</i> ..	190	13	23	15

Those of the corresponding bone in the mandrill and *Theropithecus* are given for comparison.

The large radius measures 22 mm. across its upper end, indicating a larger animal than any baboon with which comparison could be made.

The *ulna* is represented by one specimen from the left side, wanting the distal epiphysis. This is about the same size as the ulna of the Anubis baboon, but is more massive throughout. Its length (without the lower epiphysis) is 224 mm; the ulna of the mandrill (measured in the same way) 220 mm., and that of *Theropithecus* 195 mm. It indicates a large animal, but not so large as that to which the larger radius belonged.

The *os innominatum* is represented by two imperfect specimens, one larger than the other and of very massive build. In both only the region of the acetabulum is preserved, the ends of the ilium, pubis, and ischium being lost. The pelvis is more heavily built than in the mandrill. The approximate antero-posterior diameter of the acetabulum is 30 mm., in the mandrill 28 mm., and in the male *Theropithecus* 25 mm.

The *femur* is represented by the proximal end of a large specimen and the shaft of a smaller one, both of the right side. In the large specimen the diameter of the head is 28 mm., the width of the neck 20 mm., the width of the upper end of the bone as a whole 56 mm. In a mandrill femur 258 mm. long the corresponding measurements are 25 mm., 18 mm., and 50 mm. The digital fossa is very deep. The shaft of the smaller specimen is nearly circular

in section as in the mandrill and *Theropithecus*; its antero-posterior diameter is 18 mm., that from side to side 16 mm. There is a very strongly developed *linea aspera*.

The *astragalus* has a much less prominent flange on the inner side beneath the tibial facet and the surface for the internal maleolus is more concave than in the astragali of baboons with which it was compared.

The *calcaneum* does not present any special peculiarity; its length is 49 mm., in the mandrill skeleton used for comparison it is 46 mm. The *cuboid* is longer and narrower than in the mandrill.

So far as they go, the limb-bones seem to indicate that there probably was considerable difference in size in the sexes, the male being a very large and powerful animal.

EXPLANATION OF PLATE XV.

Fig. 1. Anterior portion of skull of *Simopithecus oswaldi*, from right side.

(Type-specimen.) $\frac{3}{4}$ nat. size.

Fig. 2. Ditto, palatal view. $\frac{3}{4}$ nat. size.

Fig. 3. Right upper molars of a younger individual. Nat. size.

Fig. 4. Mandible, from left side. $\frac{3}{4}$ nat. size.

Fig. 5. Lower molars and premolars. Nat. size.

Fig. 6. Lower canine of male. Nat. size.

c., canine; pm. 3-4, third and fourth premolars; m. 1-3, molars.

XLVIII.—On some of the Cranial and External Characters of the Hunting Leopard or Cheetah (*Acinonyx jubatus*).

By R. I. POCKOCK, F.R.S., Superintendent of the Zoological Society's Gardens.

SINCE 1830, when the hunting leopard, commonly known in England as the cheetah, was severed by Wagler from the genus *Felis* under the name *Cynailurus*, there has been almost complete unanimity with regard to its claim to generic rank. In a great majority of text-books, monographs, and systematic lists it is quoted as *Cynælurus*; but the oldest available title appears to be *Acinonyx*, proposed by Brookes in 1828*.

* Quoting from Palmer's Index, the full synonymy is:—

Acinonyx, Brookes, Cat. Anat. & Zool. Mus. of Joshua Brookes, p. 33 (1828); Burnett, Q. J. Sci. Lit. & Art, xxviii., 1829 (1830).

Cynailurus, Wagler, Nat. Syst. Amph. p. 30 (1830).

Guepardus, Duvernoy, L'Institut, Paris, ii. no. 51, p. 145 (1834).

Cynofelis, Lesson, Nouv. Tabl. Règne Anim., Mamm. p. 48 (1842).

The character usually cited as distinctive of *Acinonyx* is the incomplete sheathing of the claws, owing to longer or weaker retractile ligaments than are found in other forms of Felidæ. To this have been added the relatively longer limbs and thinner body and one or two cranial features, such as the absence of the inner lobe on the upper carnassial and the smallness of the anteorbital foramen. But since the cranial characters mentioned are not distinctive, and the thinness of the body and length of limb are approximately equalled in some of the typical Felidæ, *e. g.*, the serval (*F. serval*), and the characters derived from the feet are very imperfectly

Fig. 1.



Jaws of *Acinonyx jubatus*, nat. size, showing particularly the obliteration of the postcanine space when the mouth is closed.

described and understood, it may be useful to state what are the actual differences between *Acinonyx* and other members of the family.

Skull.—Neither of the cranial characters quoted above as alleged to be distinctive of *Acinonyx* can be granted that claim. The skull, nevertheless, presents a combination of features quite important enough, in my opinion, to justify the admission of the genus without taking the feet or other characters into consideration.

The skull is short, high, and dome-shaped, the facial and cranial regions being tolerably evenly and steeply sloped from the interorbital region of the frontals. The face is not

more strongly sloped than in some other forms of Felidæ, e. g., *Felis manul* and *F. pardina*, but the slope of the upper-side of the cranium is unusually steep, and is accompanied by the deflection of the basicranial axis, so as to form a more obtuse angle with the plane of the palate than is observable in any other species of the family.

A marked peculiarity lies in the set of the teeth, very noticeable when the jaws are closed (fig. 1). There is then no space behind the upper canine. The obliteration of this space, present to a varying degree in all other species of Felidæ, arises from the correlation of three features:—(1) The anterior portion of the mandible carrying the canine is not elevated, the edge of the alveolus of that tooth being in a line with the alveoli of the cheek-teeth; (2) the first premolar of the mandible and the first large premolar of the maxilla are set comparatively close to the lower and upper canines respectively, so that the lower premolar in question, together with the minute first premolar (pm^2) of the maxilla, blocks the space behind the upper canine; (3) the cheek-teeth of the maxilla overlap those of the mandible externally to such an extent that the point of the median blade of the upper carnassial reaches about one-third of the distance between the alveolar border and the inferior edge of the mandible. Nevertheless, in other members of the Felidæ the extent to which the postcanine space is developed varies enormously. It is largest in *F. nebulosa*, smallest apparently in *F. pardalis*; and, with respect to this character, there is less difference between *Acinonyx* and *F. pardalis* than between the latter and *F. nebulosa*.

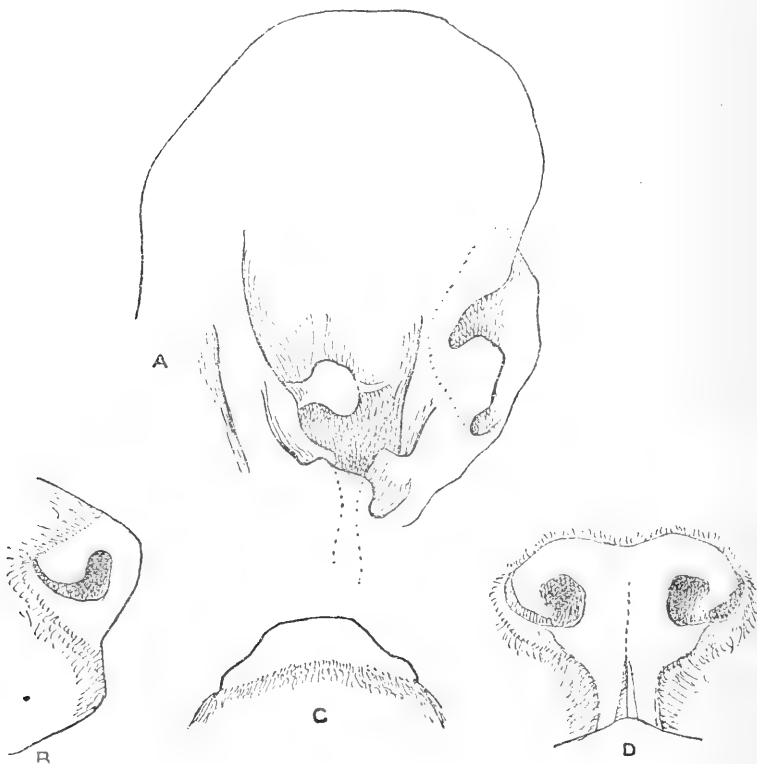
Other dental characters are the relative smallness of the canines, the narrowness of the alveolar border of the pre-maxillæ, and the suppression of the cusp on the small inner lobe of the upper carnassial, so that the anterior blade of the lower carnassial, as I have elsewhere recorded*, slides over the median blade of the upper almost to the palate. This modification contributes to the close fitting of the upper and lower cheek-teeth mentioned above.

One or two other characters of the skull may be briefly alluded to:—(1) The jaws are narrowed anteriorly, the planes of the lower half of the maxillæ inclining obliquely forwards and inwards almost in the same line as the sub-orbital portion of the zygomata, which are less salient than in most other species of Felidæ. (2) The nasals are long and posteriorly wide, the width of each in a line with the tip of the short nasal process of the frontal being approximately as

* Ann. & Mag. Nat. Hist., Sept. 1916, p. 276.

wide as the adjacent maxilla at the same level. (3) The maxillæ are evenly narrowed above, their apex being on a level with the nasals above. (4) The anteorbital foramen is very small, sometimes divided, always set far below the orbital edge, and there is no thickening of the maxilla or zygoma

Fig. 2.



- A. Left ear of *Acinonyx jubatus*.
 B. Rhinarium of the same, from the side.
 C. The same, from above.
 D. The same, from the front.

externally to it. (5) The orbital floor is more reduced than in *Panthera* even. (6) The bulla has a comparatively high partition, as I have already recorded*. (7) The anterior

* Ann. & Mag. Nat. Hist., Oct. 1916, p. 333, fig. 7.

narial aperture is large. (8) The posterior narial aperture is unique in size, its height from the palate to the presphenoid being approximately equal to its width.

The Principal External Characters.—As I have said, the serval is almost as long in the leg and compressed in the body as the hunting leopard, but the latter entirely lacks the elasticity of gait and suppleness of body and limb so noticeable in all the typical members of the family. The head is rounded and relatively smaller than in any other genus; but I can find nothing in the facial vibrissæ, the rhinarium, or the ears generically distinctive of *Acinonyx*.

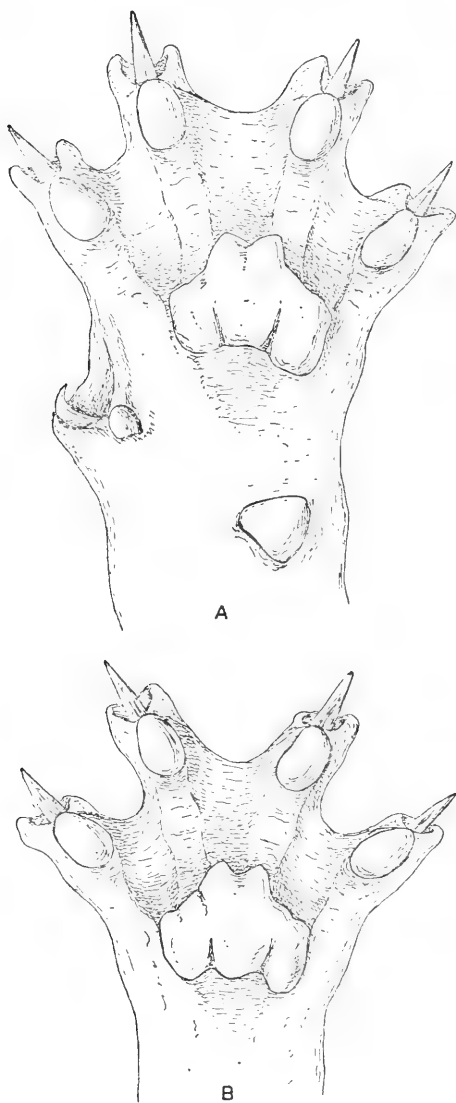
As in other Felidæ, the interramal tuft of *facial vibrissæ* is absent. The mystacial and superciliary tufts are shorter than in the majority of cats, and the two genal tufts are obsolete in the specimens examined. They are, as a rule, but not by any means always, conspicuous in the family, and it may be inferred that their functional, if not actual, suppression in *Acinonyx*, as well as the comparative shortness of the superciliary and mystacial vibrissæ are an adaptation to life in open country.

The *rhinarium* (fig. 2, B, C, D), when viewed from above, shows a tolerably large naked area, the hairs of the muzzle forming a convex line extending transversely from the posterior end of the narial slits. From the lateral aspect the rhinarium is prominent above, its edge sloping downwards and backwards to the upper end of the dilatable naked tract cleaving the upper lip. The deep gutter impressing this tract is continued upwards as a shallow groove between the anterior nares, which are comparatively large and encircled laterally by a narrow strip of naked skin.

The *ear* (fig. 2, A) has a large bursa with the anterior flap or lamina deeply notched. The antero-internal ridge shows a small angular excrescence overlapping the base of the supratragus (*plica principalis*), which exhibits a large and rounded excrescence. The antero-external ridge ends inferiorly in a long low tragus. The postero-internal and postero-external ridges are well developed, and the latter carries a rectangular antitragal elevation fitting behind the tragus.

The *anus* and *external genitalia* are normal. The area between the anus and the scrotum and the scrotum itself are hairy. The prepuce, which is close in front of the scrotum, is naked mesially, hairy laterally. The glans penis is short and subconical, with lightly convex lower margin, correspondingly concave upper margin, and pointed apex. Its surface is beset with lineally arranged spicules, which are

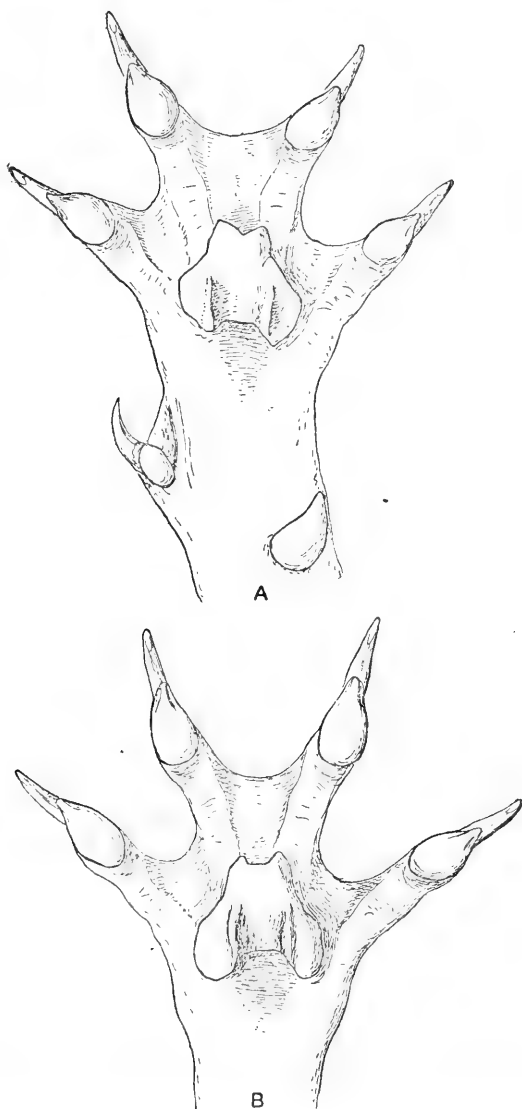
Fig. 3.



- A. Lower view of extended left fore paw of common leopard (*Panthera pardus*), with the hairs cut short to show the extent of the interdigital webs and the integumental claw-sheaths.
B. The same of the left hind paw.

Both figures are one-half natural size.

Fig. 4.



- A. Lower view of extended left fore paw of cheetah (*Acinonyx jubatus*), with the hairs cut short to show the extent of the interdigital webs and the complete absence of integumental claw-sheaths.
- B. The same of the left hind paw.

Both figures one-half natural size.

coarser at the base than at the apex of the glans, where they become obsolete. As is well known, the domestic cat (*Felis catus*) has a spicular glans; but in a leopard (*Panthera pardus*) the glans was smooth.

Feet.—For a proper appreciation of the peculiarities of the feet of *Acinonyx* it is necessary briefly to describe those of one of the more typical members of the family. The feet of the common leopard (*Panthera pardus*) will serve as well as another for this purpose.

The fore paw is broad (fig. 3, A). The webs extend almost up to the distal ends of the digital pads, which are smooth and soft and subelliptical in shape, with rounded distal ends. The plantar pad is large, wide, asymmetrical, and smooth and cushion-like, and marked posteriorly by two shallow grooves defining the lateral lobes. The pollical pad is small and rounded and set approximately half-way up the space between the plantar and carpal pads. This space is less than the width of the plantar pad, and the carpal pad is large, cordate, and apically rounded.

The claw of the pollex is enveloped by a hood-like sheath. The sheaths of the claws of the remaining digits consist of a pair of lobes—an external and internal—connected over the base of the claw above by a flap of integument. These lobes are sufficiently large to conceal the tips of the retracted claws.

The hind foot (fig. 3, B) in its general features is similar to the fore foot, but is a little smaller, has the plantar pad more symmetrical, the edges of the webs considerably more emarginate and scarcely extending beyond the proximal ends of the digital pads, and the claw-sheaths considerably smaller, especially the inner lobes of the second, fourth, and fifth digits, the claws of which are sheathed mainly externally, *i. e.*, away from the middle line.

The feet of *Acinonyx* were by Mivart dismissed as differing from those of *Felis* in having imperfectly retractile claws, although the retractile elastic ligaments found in *Felis* are present. The function of these ligaments is to pull the terminal claw-bearing phalanx alongside the outer surface of the penultimate phalanx, thus raising the tip of the claw off the ground. So far as the action of these ligaments is concerned, the claws of this genus are approximately, if not quite, as retractile as in some species of *Felis*. The incompleteness of their withdrawal, therefore, arises from some other factor—and this is the total absence of the lobes of skin constituting the claw-sheaths in *Felis* *.

* Lydekker, therefore, is misleading when he says "the claws can only be partially withdrawn into their protecting sheaths" (Royal Nat.

That is the primary difference between the feet of *Acinonyx* and of other genera of Felidæ.

There are other differences, however, of considerable interest. In the fore foot (figs. 4 A, 5 B) the median web between the third and fourth digits just reaches the proximal end of the digital pads and has a widely emarginate border. The lateral webs are much shallower and do not reach the proximal ends of the pads of the second and fifth digits, but the web tying together the fourth and fifth digits is considerably more deeply emarginate than that joining the second and third digits.

The pads are hard and smooth. The digital pads are strongly compressed and hard in front beneath the base of the claws, and are upturned somewhat as in *Hyaena*, and the narrow plantar pad is provided on each side of its highest portion posteriorly with a strong longitudinal ridge.

The pollex is situated high above the plantar pad; its pad is elliptical. The carpal pad is large, piriform, projecting, and furnished with a hard sharp point.

The hind foot (fig. 4 B) is subsymmetrical, a little larger than the fore foot, and has slightly larger pads, and all the webs are shallower and more deeply emarginate. The pads are very similar in form to those of the fore foot, but the plantar pad, as is usually the case in Felidæ, is more symmetrical.

In both the fore and hind feet the interdigital spaces are thickly clothed with long hairs.

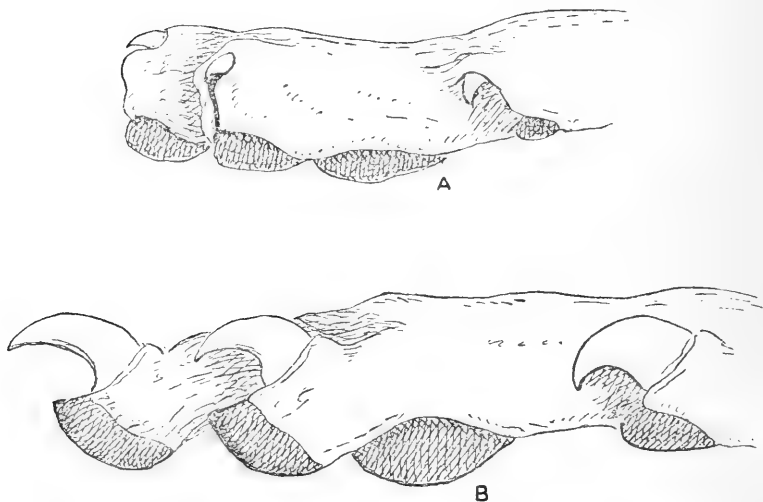
As the description and figures show, the feet of *Acinonyx* are very different from those of *Panthera*. They are equally different from the feet of several species referred to *Felis*, but by no means so different from them all, because within the limits of that genus, as at present understood, there is very considerable variation in the development of the claw-sheaths and interdigital webs. These I propose to deal with in a subsequent paper. At present it is sufficient to state that the feet of *Acinonyx* differ from the feet of all other species of Felidæ in the complete absence of integumental claw-sheaths, and that it is to this modification mainly that the so-called imperfect withdrawal of the claws is due.

Mr. Lydekker was, I believe, expressing the prevalent

Hist. i. p. 442, 1894) and the claws at their extremities are "always protruded from their sheaths" ("Cats" in Lloyd's Nat. Hist. p. 201, 1896). Clearly, also, Flower did not know the facts of the case when he described the claws as being less completely retractile "owing to the feebler development of the elastic ligament" ('Mammalia,' p. 523, 1891).

opinion with regard to the feet of *Acinonyx* when he described them as more generalized than those of *Felis*; but, since the only character he was acquainted with was the imperfect withdrawal of the claws, his remark applied solely to that point. I believe, on the contrary, that that character, as well as the others in which the feet depart from the feline type, have been secondarily acquired in adaptation to this animal's

Fig. 5.



- A. Lateral view of right fore paw of ocelot (*Felis pardalis*), showing the plane of the digital pads and tips of the claws protruding from the integumental sheaths. (The paws of *F. pardalis* are very similar to those of *Panthera pardus*.)
- B. The same of *Acinonyx jubatus*, showing the uptilting of the digital pads, the slightly less elevated claws, and the complete absence of protective integumental sheaths.

These figures (nat. size) are taken from specimens with the hairs of the paws cut short.

peculiar method of hunting. As is well known, the cheetah does not, at all events as a rule, adopt the true cat's method of pouncing on its prey from a point of vantage at comparatively close quarters, but runs down antelope in the open by sheer speed of foot. All its more obvious external features—its small light head, narrow chest and body, long, thin, sinewy legs, and powerful hind quarters—are obviously adapted to that

end. So, too, with the feet. The protruding claws, hard, pointed, digital pads, ridged plantar pads, deeply emarginate webs, and wide hind feet are all better fitted for securing a firm hold upon hard or sandy ground and for traversing it swiftly and surely than are the softer more pliable feet of other members of the cat tribe; and I think it is probable that the long, rigid, and sharp carpal pad, when jammed against the soil, aids in arresting the headlong rush when a rapid turn after the pursued quarry is required. The long heavy tail, too, probably acts as a balance in wheeling at full speed. Similarly, the great enlargement of the posterior narial orifice must be regarded as a modification serving the end of admitting an abundant supply of air to the lungs to maintain the maximum of speed over the comparatively long distance that often has to be traversed before the fleet-footed quarry is overtaken*.

Reverting once more to the feet, it is interesting to note that of all the species of Felidæ the caracal (*F. caracal*) comes nearest to the hunting leopard (*Acinonyx*) in the structure of the hind feet, and the caracal is the only other species of the family, so far as I am aware, which is trained in much the same way in certain parts of India for hunting game†.

XLIX.—The Melolonthine Beetles of Ceylon.

By GILBERT J. ARROW.

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IN a pamphlet ('All about Grub,' by R. C. Haldane) published in Ceylon in 1881 the enormous amount of damage to the coffee-plantations of the island due to the root-destroying larvæ of the Melolonthinæ was described, and a rather unsuccessful attempt made to distinguish the various species of cockchafer (as they are collectively called) responsible for the injury. In an appendix the statement is made that "It

* According to Major F. G. Alexander ('Harmsworth's Natural History,' i. p. 414, 1910) the hunting leopard can keep up its speed for 500 yards or more.

† Blanford ('Mammals of British India,' p. 89, 1883):—"Some Indian princes are said to have kept a large number of caracals for the purpose of hunting. Vigne, who saw them used, says that their speed is, if possible, greater in proportion even than that of the hunting leopard."

will, perhaps, surprise many planters to learn that there are between 15 and 20 kinds of cockchafers to be found in Ceylon." The enumeration which follows shows that the term is used in a wide sense, which includes not only the Melolonthinæ, but the allied subfamily Rutelinæ, of which alone I have enumerated, in two recent papers in the Ann. & Mag. Nat. Hist., 45 species found in Ceylon. The Ceylon Melolonthinæ were dealt with systematically by Brenske in Stett. ent. Zeit. 1900 (p. 341), and a total of 48 species counted. In the list which follows I enumerate 70, and it is quite certain that this number will be largely increased by future collecting. My present object is less to add to the list than to correct its nomenclature, which is in a very confused state, chiefly owing to the numerous and quite worthless descriptions of Walker, in which generic names are applied at random and all characters of real importance completely ignored. The types of these being in the British Museum, I have attempted to finally remove this difficulty.

One very large and remarkable insect included in Brenske's list (*Eucirrus mellyi*) is now omitted. It occurs in Borneo, Sumatra, and the Malay Peninsula; but there can be no doubt, I think, that its attribution to Ceylon is merely an ancient error. Another Melolonthid described as Ceylonese (*Trichoderma ceylanica*, Nonfr.) has been recently declared by Moser to have actually come from South America (Deutsche ent. Zeits. 1912, p. 325).

Three of Walker's species supposed by Brenske to belong to this group, although unrecognizable by him, really belong to the Rutelid genus *Anomala*. They are "*Omaloplia*" *fracta*, *hemifera*, and *semicincta*. Three others—*Rhizotrogus sulcifer*, *Plectris glabrilinea*, and *Plectris punctuligera*—with the other species called Addenda by Walker (Ann. Nat. Hist. (4) iii. 1859, p. 219) have never been found, and may or may not belong to this group.

An interesting point in connection with this part of the Ceylon fauna is the total absence of the Hopliini, which are numerous in the northern parts of India, as well as in Assam, Burma, and the Malayan Region.

The types of the new species in the following list are in the British Museum. Nearly all were found by Mr. E. E. Green or Mr. George Lewis, or by both:—

Periserica (" *Isonychus* ") *ventralis*, Walk.

P. picta, Brenske.

P. fulvostriata, Brenske. This was described by Brenske as a variety of the preceding, but it is quite distinct.

Periserica (" *Omalopecta* ") *interrupta*, Walk.

P. (" *Sericesthis* ") *subsignata*, Walk. The type is a unique and very defective female.

P. nigripennis, sp. n.

Selaserica nitida, Cand.

S. scutellaris, sp. n.

S. sericea, sp. n.

S. pusilla, sp. n.

Serica variolosa, Motsch. = *S. maculifera*, Brenske. Although Motschulsky's description of the legs is rather incomprehensible, there seems to me to be no reasonable doubt that his insect, which Brenske found himself unable to identify, is the latter's *S. maculifera*. It is curious that Brenske has charged Motschulsky with omitting to give the dimensions—a fault of which he is not guilty, but which Brenske himself, in the same paper, has perpetrated more than once (see *Autoserica cinerea* and *Neoserica splendida*, p. 431).

S. rubescens, sp. n.

S. fusa, Brenske.

S. lurida, Brenske. This and the two following species are unknown to me.

S. nana, Brenske.

S. distincticornis, Brenske.

S. (" *Sericesthis* ") *confirmata*, Walk.

S. maculicauda, sp. n.

Autoserica (" *Sericesthis* ") *mollis*, Walk. = *A. singhalensis*, Brenske.

Brenske has referred to the considerable variations in size exhibited by this insect. The smaller form, to which his type belongs, is generally distinguishable by sharper hind angles to the pronotum and less sharp and rather abbreviated supramarginal carinae to the elytra. It can hardly be regarded as specifically distinct.

A. (" *Sericesthis* ") *rotundata*, Walk. = *S. immunita*, Brenske.

A. straba, Brenske. I do not know this species or the two which here follow.

A. implicata, Brenske.

A. fistulosa, Brenske.

A. cinnabarina, Brenske.

A. calcarata, Brenske.

A. chalybæa, Brenske.

A. veligamana, Brenske.

A. dubia, sp. n.

A. cinerea, Brenske. Unknown to me.

A. pubescens, sp. n.

Neoserica bombycina, Karsch.

N. splendida, Brenske. Unknown to me.

Apogonia rauca, F. = (" *Anomala* ") *punctatissima*, Walk. I believe *Apogonia soluta*, *liberata*, and *intacta*, of Kolbe (the last mistakenly referred to as "*incerta*" and "*inserta*" by Brenske, Stett. ent. Zeit. 1900, p. 349), to be forms of *A. rauca*, F., as well as Brenske's var. *unistriata*.

A. proluxa, sp. n.

A. ferruginea, F. = *A. uniformis*, Bl., and *A. anfracta*, Karsch. The types of *A. ferruginea* and *rauca* are in the British Museum.

A. cava, Karsch. This is a doubtful species. The fragmentary description applies entirely to *A. ferruginea*, of which the type may be a rather large specimen.

Apogonia (" *Plectris* ") *solida*, Walk. = *A. ludificans*, Brenske. This was described by Brenske as a variety of *A. comosa*, Karsch, but I believe it to be specifically distinct. It is invariably larger, with the head and pronotum less closely punctured and the front tibia less produced at the end.

A. comosa, Karsch. I consider it doubtful whether this really occurs on the mainland of India as maintained by Brenske.

A. lateralis, sp. n.

A. lurida, Karsch.

A. nana, Walk. The type is unique and in bad condition.

A. equabilis, Karsch.

A. gracilis, sp. n.

A. coriacea, Wat.

A. nietneri, Kolbe.

A. fulvosetosa, sp. n.

Schizonycha ruficollis, F. = (" *Rhizotrogus* ") *equalis*, Walk, and *S. singhalensis*, Brenske. This was described by Fabricius from Southern India, and Brenske gives no sufficient reason for distinguishing the Ceylonese specimens. After a careful comparison of many examples from both Ceylon and the mainland (including the types of Walker and Fabricius) and a male specimen determined by Brenske himself as *S. singhalensis* I have come to the conclusion that they are identical. The genitalia of the males are alike.

Engertia maculosa, Brenske. A peculiar insect, decorated with patches of scales, of which apparently only a single female is yet known. Confirmation is needed of its Ceylon habitat.

Lepidiota (" *Melolontha* ") *ferruginosa*, Walk.

Leucopholis pinguis, Burm. = " *Melolontha* " *rubiginosa*, Walk.

L. horni, Brenske. Unknown to me.

Stephanopholis singhalensis, Brenske.

S. rubicundus, sp. n.

S. cribricollis, sp. n.

S. melonothoides, Brenske. Brenske saw specimens of this labelled "Columbien" and "Manila," both of them improbable localities. It seems possible that the former was a mistake for Colombo; but I do not know the species.

Holotrichia serrata, F. = *H. ceylonensis*, Moser. The minute differences pointed out by Moser do not seem to indicate more than a slight local race, of which probably many might be distinguished in this wide-ranging species.

H. insularis, Brenske.

H. reynaudi, Blanch. = " *Melolontha* " *pinguis*, Walk., and *H. remorata*, Brenske. M. Lesne has kindly established this synonymy for me by examination of Blanchard's type in the Paris Museum. In his table of the Ceylon species (Stett. ent. Zeit. lxi. 1900, p. 358), and in Mem. Soc. Ent. Belg. ii. 1894, pp. 19 & 66, Brenske has applied Blanchard's name to the following species.

H. disparilis, sp. n. = *Holotrichia reynaudi*, Brenske.

H. scabrifrons, Brenske. This species, described from a single male in 1892, Brenske has entirely omitted in his table of 1900. Mr. G. Lewis found a single female, now in the British Museum, at Bogawantalawa.

H. (" *Rhizotrogus* ") *inducta*, Walk.

H. (" *Rhizotrogus* ") *hirtipectus*, Walk. = *H. convexifrons*, Moser.

H. (" *Melolontha* ") *setosa*, Walk.

H. rufoflava, Brenske.

Brahmina flavipennis, Moser, Deutsche ent. Zeits. 1913, p. 276.

Microtrichia eurystoma, Burm. = (" *Rhizotrogus* ") *exactus*, Walk., and *M. parva*, Brenske. Brenske applies the name *exacta* to small specimens of *eurystoma*, but the latter name is used by him for the following species.

M. furcifer, sp. n. This species, of which the male has a long antennal club and a remarkable pair of prongs at the end of the abdomen, has been carefully described by Brenske (Berl. ent. Zeit. xxxvii. 1892, p. 176) under the name of *M. eurystoma*, Burm. Burmeister's comparison with *Rhizotrogus ruficornis*, the words "nitidus" and "glänzend," and particularly the "kurzborstig" clothing of the body beneath clearly exclude the present insect.

Microtrichia (" *Rhizotrogus* ") *costata*, Walk. = *M. puttalama*, Brenske.

M. singhalensis, Brenske.

Idiuchelyna, gen. nov. (" *Isonychus* ") *pectoralis*, Walk.

The genus *Periserica* is represented in the recent 'Catalogue of the Melolonthinæ' by only two species, of which one — *Omaloplia fracta*, Walker—really belongs to the Rutelinæ. Walker actually described three species of the genus, which he distributed amongst three different genera, and six are now known to me, all inhabitants of Ceylon. They will, perhaps, be recognizable from the following key:—

- | | | |
|-----------|--|--------------------------------|
| 1 (8). | Upper surface pruinose. | |
| 2 (5). | Form short and globular. | |
| 3 (4). | Sides of the pronotum yellow | <i>picta</i> , Brenske. |
| 4 (3). | Sides of the pronotum not yellow . . . | <i>ventralis</i> , Walk. |
| 5 (2). | Form more elongate. | |
| 6 (7). | Pronotum and elytra yellow and black. | <i>fulvostriata</i> , Brenske. |
| 7 (6). | Elytra entirely black | <i>nigripennis</i> , sp. n. |
| 8 (1). | Upper surface shining. | |
| 9 (10). | Elytra pale, with dark marks | <i>interrupta</i> , Walk. |
| 10 (9). | Elytra black, with small yellow marks. | <i>subsignata</i> , Walk. |

Periserica nigripennis, sp. n.

Nigra, capite pronoto scutelloque leviter cupreo-micantibus, pronoto prope marginem anguste flavo-vittato, elytris opacis, sericeis; elongata, fere oblonga, corpore supra parcissime sat longe setosa, capite parce punctato, clypeo medio tumido, margine antico fere recto, fronte medio fere carinato; pronoto modice punctato, lateribus vix arcuatis, angulis anticis paulo productis, posticis leviter rotundatis; scutello parcissime punctato; elytris striatis, striis minute parum regulariter punctatis, intervallis convexis, parce punctatis; pygidio modice punctato, subsericeo; tibiis anticis tridentatis:

♂, antennis 4-lamellatis, lamella prima paulo abbreviata. Long. 8 mm.; lat. max. 4.5 mm.

Hab. CEYLON: Horton Plains (May, *E. E. Green*).

A single male specimen.

This species is easily recognized by its long narrow shape, the shining head and prothorax, the latter with narrow lateral yellow stripes, and opaque silky elytra. There is a rather strong smooth elevation at the middle of the clypeus, which is scarcely emarginate in front. The head, pronotum and scutellum, and also the pygidium, are deeply but sparsely punctured. The elytra are finely, closely, and rather irregularly punctured in the neighbourhood of the striæ.

Selaserica scutellaris, sp. n.

Rufa, polita, nitida, scutello solum opaco, elongata, elytrorum latitudine maximo apicem versus; capite grosse sed parce punctato, clypeo antice valde reflexo, fere recto; pronoto parce et sat minute punctato, lateribus vix arcuatis, angulo antico paulo producto, postico rotundato; elytris profunde striatis, striis minute punctatis, interstitiis paulo convexis, minutissime et parcissime punctatis; tibiis anticis tridentatis.

Long. 10 mm.; lat. max. 6 mm.

Hab. CEYLON: Dikoya, 4000 feet (Dec., Jan., *G. Lewis*).

The type is a unique female.

This resembles *S. nitida*, Cand., but is a little smaller and relatively rather shorter and more dilated behind. It is shining, like *S. nitida*, but with the scutellum opaque and with a very feeble silky reflection upon the elytra. The few punctures upon the elytral intervals are still more fine and scanty than in *S. nitida*; the alternate intervals are not distinctly broader than the others, as in that, nor more strongly punctured. The outermost interval is well punctured, but the rest are almost smooth. The hind angles of the pronotum are more rounded.

Selaserica sericea, sp. n.

Læte rufa, sericea, vix opaca, capite nitido, ovalis, postice sat lata; capite grosse punctato, antice paulo tumido, lævigato, clypei margine antico valde reflexo, leviter emarginato, fronte medio lævigato, vix carinato, pronoto fortiter sat crebre punctato, lateraliter paulo grossius, lateribus fere rectis, angulis anticis paulo productis, posticis obtusis; scutello paulo punctato; elytris fortiter, irregulariter punctatis, striatis, striis crebre punctatis, interstitiis convexis; tibiis anticis tridentatis:

♂, antennis 4-lamellatis, lamella prima paulo abbreviata.

Long. 10 mm.; lat. max. 6 mm.

Hab. CEYLON: Bogawantalawa, 5000 ft. (between 21st March and 4th April, *G. Lewis*).

The type is a single male.

It is rather lighter red in colour than *S. nitida* and *scutellaris*, and still shorter and more dilated behind than the latter. The clypeus alone is shining, and the remainder of the upper surface not opaque, but having a strong opalescent silky lustre. The puncturation is strong and deep, very scanty upon the head, fairly close upon the pronotum and in the elytral striæ, and scanty, though coarse, upon the intervals, which are convex and of nearly uniform width.

Selaserica pusilla, sp. n.

Rufo-testacea, elytris paulo pallidioribus, nitidissima, scutello elytrorumque marginibus externis opacis, sat longe ovata, capite fortiter sat parce punctato, clypeo medio lævi, tumido, margine antico fortiter exciso et reflexo; pronoto fortiter sat crebre et æqualiter punctato, lateribus arcuatis, angulis anticis paulo acutis, posticis rotundatis; elytris punctato-striatis, punctis profundis, irregularibus, intervallis convexis, parce punctatis; tibia antica tridentata, dento supero minuto, aliis longibus:

♂, antennis æqualiter 4-flabellatis, oculis magnis:

♀, antennis longe 3-flabellatis, oculis minoribus.

Long. 7-8 mm.

Hab. CEYLON: Diyatalawa (Sept., *T. Bainbrigge Fletcher*; Oct., *E. E. Green*).

This is a very distinct species of small size, rather pale colour, and very shining surface, the scutellum and the lateral margins of the elytra alone remaining opaque. The puncturation is everywhere rather coarse and fairly close upon the pronotum and in the elytral striæ. The upper surface bears rather long but scanty erect hairs, which are more numerous at the sides and along the front margin of the pronotum. The clypeus is elevated in the middle and deeply emarginate in front. The sides of the pronotum are evenly rounded and the hind angles completely rounded away. The third tooth of the front tibia is very blunt and feeble, and the others rather long and sharp. The club of the antenna is rather long in both sexes.

The eyes of the male are large, the intervening space being less than twice the diameter of one eye as seen from above.

Serica rubescens, sp. n.

Rufescens, opaca, ovata, elytris regulariter profunde striatis, sat dense minute setosis, capillis longioribus raris erectis, prothoracis lateribus lineaque mediana flavis, capite crebre punctato, oculis haud magnis.

Long. 4-5 mm.; lat. max. 3-3.5 mm.

Hab. CEYLON: Bogawantalawa, 5000 ft. (March, April, G. Lewis); Hakgala (March, April, E. E. Green); Horton Plains (May, E. E. Green).

In his description of *Serica maculifera* (= *variolosa*, Motsch.) Brenske has mentioned a unicolorous red-brown variety. This, although very closely similar to *S. variolosa*, is undoubtedly a distinct species, to which I have given the name above. It is relatively broader than *S. variolosa*, much more red in colour, often with a yellow scutellum, and the sides and middle line of the pronotum yellow as in the other species. The eyes are smaller and farther apart, the forehead more evenly punctured and without a median carina, the elytra more deeply and regularly sulcate and more finely punctured, with more numerous minute setæ and shorter erect bristles.

Serica maculicauda, sp. n.

Rufa, elytris obscurioribus pygidioque basi nigro-biplagiato; tota opaca, sericea, clypeo, tibiis tarsisque nitidis; elongato-ovata, convexa, pedibus gracilibus; clypeo modice punctato, antrorsum attenuato, margine antico reflexo, leviter exciso, fronte et pronoto sat parce punctatis, hujus lateribus fere rectis, angulis anticis acutis, posticis rotundatis; scutello elongato, modice punctato; elytris striatis, interstitiis angustis, convexis, subtiliter parce punctatis; pygidio magis crebre punctato, haud dense erecte piloso; tibiis anticis tridentatis, dente supero obtuso; antennis 9-articulatis, clava triflabellata.

Long. 12-13 mm.; lat. max. 7-7.5 mm.

Hab. CEYLON: Namunukuli (Feb., E. E. Green).

I have seen only three male specimens.

It is a rather large species, of almost the same size and shape as *Selaserica nitida*, Cand., but covered with an opaque velvety bloom which leaves only the clypeus, tibiæ, and tarsi shining. The head, pronotum, scutellum, and lower surface are of a fairly bright red colour, the elytra very deep red, and the pygidium is decorated on each side with a large semi-circular black patch placed on the base-line. The lower

surface and pygidium are clothed with erect, not very long or close, hairs, and a very few similar hairs are traceable upon the upper surface. The legs are long and slender, the front tibiæ armed with three teeth, of which the uppermost is very blunt.

I refer this provisionally to the genus *Serica*, although, according to Brenske's unsatisfactory table of the genera (Berl. ent. Zeit. xlii. 1897, p. 354), it should be placed in a different section on account of its tridentate front tibiæ. The only alternative is the creation of another new genus, which is undesirable upon such slight ground and in the present tangled state of the group. A closely related species is "*Sericesthis*" *confirmata*, Walker, which is scarcely more than half the length of *S. maculicauda* and more elongate. These two insects have a marked affinity to the species of *Selaserica*.

Autoserica dubia, sp. n.

Nigro-fusca, clypeo pedibus corporeque subtus rufis, sericeo-opaca, sparsissime erecte setosa, elongato-ovata, pedibus gracilibus, tibia postica paulo dilatata, valde spinosa, calcare superiori longitudine ad tarsi articulum primum æquali, clypeo nitido, leviter punctato, antice paulo tumido, subtiliter emarginato; pronoto parce et minute punctato, lateribus fere rectis, antice leviter arcuatis, angulis posticis fere rectis; scutello elongato, acuto; elytris punctato-striatis, interstitiis convexis, vix punctatis; pygidio parce subtiliter punctato:

♂, oculis magnis, clava antennali longe triflabellata.
Long. 8-9 mm.

Hab. CEYLON: Pattipola (May, *E. E. Green*).

This species closely resembles *A. veligamana*, Brenske, and I have, therefore, referred it to *Autoserica*, although in both species the legs are slender, and they would be almost equally well placed in the genus *Serica*.

A. dubia has the same elongate-oval shape as the allied species, as well as the dark brown colour and dull silky lustre of the upper surface; but the minute scale-like setæ are scarcely perceptible and the erect bristles are extremely few. In the male the eyes are much larger (the diameter of each not much less than the width of the space separating them) and the club of the antenna is much longer. The puncturation is very fine everywhere, moderately close in the elytral striæ, and very sparse elsewhere. The clypeus is very shining, feebly emarginate in front, the front tibia strongly

bidentate, the hind tibia a little dilated and bearing very long and stout spines, the upper terminal one as long as the basal joint of the tarsus.

Autoserica pubescens, sp. n.

Brunnea, ovalis, cinereo-pubescens, capite nitido parce inæqualiter punctato et erecte setoso, clypeo antice leviter tumido, margine antico fere recto, fortiter reflexo, pronoto, scutello et elytris æqualiter dense punctatis et subtiliter cinereo-setosis.
Long. 6-6.5 mm.

Hab. CEYLON: Colombo (April, *E. E. Green*); Yatiyantota (Sept., *E. E. Green*).

This appears to be very similar to *A. cinerea*, Brenske, and is probably the species described by Brenske with the designation No. 106. The upper surface is finely, densely, and uniformly punctured and closely clothed with short grey decumbent hairs, except the head, which is shining, thinly and irregularly punctured, and bears only a few erect bristles. The first joint of the hind tarsus is longer than the second, and the antennal club of the male is as long as the footstalk.

Kolbe has enumerated (*Ent. Nachr.* xxv. 1899, p. 198) eleven species of *Apogonia* inhabiting Ceylon. Although I do not recognize several of these, there is no doubt that the actual number is considerably larger. Omitting the doubtful *A. cava*, Karsch, those now known to me may be tabulated as follows:—

- | | |
|---|----------------------------|
| 1 (18). Body naked above. | |
| 2 (15). Elytra not relatively long. | |
| 3 (14). Elytra strongly punctured. | |
| 4 (13). Forehead shining, not densely punctured. | |
| 5 (10). Pronotum well punctured. | |
| 6 (9). Elytra not very densely punctured. | |
| 7 (8). Tarsi long, those of the ♂ very broad and clypeus bilobed | <i>æquabilis</i> , Karsch. |
| 8 (7). Tarsi shorter, male and female similar | <i>ferruginea</i> , F. |
| 9 (6). Elytra very densely punctured | <i>rauca</i> , F. |
| 10 (5). Pronotum sparsely punctured. | |
| 11 (12). Punctures of pronotum coarse | <i>prolixa</i> , sp. n. |
| 12 (11). Punctures of pronotum fine | <i>nana</i> , Walker. |
| 13 (4). Forehead densely punctured, not shining . | <i>lurida</i> , Karsch. |
| 14 (3). Elytra finely punctured | <i>nietneri</i> , Kolbe. |
| 15 (2). Elytra relatively long. | |
| 16 (17). Large; pronotum scarcely punctured | <i>coriacea</i> , Wat. |
| 17 (16). Small; pronotum distinctly punctured .. | <i>gracilis</i> , sp. n. |

- 18 (1). Body clothed with hair or scales above.
 19 (24). Clothing consisting of long erect hairs.
 20 (23). Elytra without opaque lateral margins.
 21 (22). Forehead not densely punctured *solida*, Walker.
 22 (21). Forehead densely punctured *comosa*, Karsch.
 23 (20). Elytra with opaque lateral margins..... *lateralis*, sp. n.
 24 (19). Clothing consisting of scales or setæ *fulvosetosa*, sp. n.

These insects are generally subject to considerable variation, and there is no apparent advantage in applying names to their various phases, as has been done by Brenske and Kolbe.

The new species named above are here described.

Apogonia prolixa, sp. n.

Obscure ænea vel viridi-nigra, tarsis antennisque rufis; robusta, modice elongata, convexa, nitida, fere nuda; clypeo brevi, fortiter punctato, antice lævissime emarginato, fronte parce sed profunde, pronoto grosse et parcissime, punctatis, hujus lateribus post medium fortiter arcuatis, antice et postice valde contractis, angulis anticis acutis, posticis obtusis; scutello elongato, fere impunctato; elytris fortiter ac crebre punctatis, lineis discoidalibus 2 geminatis parum perspicuis; pygidio grosse punctato; corpore subtus fortiter, lateraliter crebre punctato; tibiis anticis 3-dentatis, dente supero obtuso.

Long. 12 mm.; lat. max. 7 mm.

Hab. CEYLON: Ambawela (April, *E. E. Green*).

Only a single female specimen was found.

This is most nearly related to *A. rauca*, F., but is more elongate, the pronotum especially being narrow and strongly contracted in front and behind, so that the general outline is less compact. The clypeus is very gently emarginate. The puncturation, though equally strong, is much less close than in *A. rauca*. The pronotum is only very scantily punctured and the scutellum is long and almost smooth, having only a very few minute and inconspicuous punctures. The third tooth to the front tibia, although feeble, is very distinctive, as there is no trace of it in *A. rauca*.

Apogonia gracilis, sp. n.

Castanea, lateribus nonnunquam dilutioribus, capite (clypeo excepto) tibiisque fuscis, corpore subtus, pygidio, femoribus, tarsis antennisque flavescens; elongato-ovata, angusta, nitida, glabra, fere nuda; clypeo brevi, fortiter punctato, antice leviter emarginato, angulis rotundatis; fronte et vertice parce et irregulariter

minute punctatis, convexis; pronoto parce haud fortiter punctato, lateribus arcuatis, angulis anticis fere rectis, posticis obtusis; scutello lævi; elytris elongatis, sat fortiter haud crebre punctatis, lineis longitudinalibus angustis elevatis parum distinctis; pygidio punctis paucis magnis profunde impresso; pedibus gracilibus, tibiis anticis tridentatis, dentibus duobus inferioribus approximatis, haud acutis:

♂, oculis magnis, clypeo angustiori, fortius emarginato.
Long. 8-9 mm.; lat. max. 4-4.5 mm.

Hab. CEYLON: Hakgala (May, *E. E. Green*); Pattipola (May, *E. E. Green*).

This species is very peculiar from its smooth shining upper surface and very long narrow form, due to the elongation of the elytra, the head and prothorax being very short. Its nearest ally seems to be *A. coriacea*, Wat., but it is smaller, much more elongate, and light brown in colour, with the tibiæ and the hinder part of the head dark. The puncturation is deep, though rather scanty. The legs are long and slender, the front tibia armed with three teeth, of which the uppermost is small and rather remote from the other two, which are close together, blunt, and not long.

There is considerable difference between the sexes. The male has the eyes larger and more prominent, the clypeus narrower and more strongly emarginate, the tarsi longer and more hairy and the front ones dilated. The abdomen is contracted beneath in this sex, the pygidium ventral in position and very protuberant.

Apogonia lateralis, sp. n.

Fusco-brunnea, antice leviter metallica, paulo relucens, supra undique erecte pilosa, breviter ovata; capite dense sat fortiter punctato, clypeo breviter rotundato-truncato; pronoto etiam fortiter et crebre punctato, basi medio paulo lobato, lateribus post medium valde angulatis, antice rectis, angulis omnibus obtusis; scutello minutius punctato; elytris fortiter ac dense punctatis, costis duabus discoidalibus angustis parum perspicuis, marginibus externis ab ante medium ad apicem haud late opacis; pygidio nitido, grosse punctato, corpore subtus fortiter haud dense punctato; tibia antica fortiter bidentato, dente apicali longo et curvato.

Long. 7-7.5 mm.; lat. max. 4.5 mm.

Hab. CEYLON: Northern Province, Killinochchi (November, *E. E. Green*).

A small, feebly metallic, brownish species, thickly clothed

with erect pale hair, and very similar to *A. comosa*, Karsch. It differs from that in having the head still more closely punctured, the sides of the pronotum more strongly rounded behind the middle, the terminal tooth of the front tibia more produced and the upper tooth shorter, but most markedly by the peculiar opaque band bordering the elytra externally. This is due to a microscopic sculpturing of the surface upon this area, which extends from near the middle of the outer margin to the sutural angle. It is flattened, and the punctures upon it are partially obliterated.

Four specimens were taken by Mr. Green.

Apogonia fulvosetosa, sp. n.

Obscure rufo-cuprea, undique breviter squamoso-setosa, setis fulvis, decumbentibus, corporis supra inæqualiter dispersis, corpore subtus squamis minutis regularibus vestito; robusta, sat lata, capite grosse inæqualiter punctato, clypeo brevi, punctato; pronoto rugose punctato, fossis vagis nonnullis lineaque lævi interrupta mediana prædita, lateribus post medium fortiter arcuatis, angulis anticis productis acutis, posticis obtusis; scutello crebre punctato et squamoso; elytris crebre punctato-rugosis, callis humeralibus et apicalibus prominentibus; pygidio grosse et rugose punctato, medio anguste carinato; pedibus gracilibus, tibia antica dentibus duobus brevibus tertioque vix perspicuo armata:

♂, tarsis paulo longioribus.

Long. 11-12 mm.; lat. max. 8 mm.

Hab. CEYLON: Peradeniya (*E. E. Green*).

Mr. Green found two specimens of this—a female in April and a male in the following May. It is of great interest from the fact that the nearest allied species are found in Celebes and other Malayan islands. It is a large compact insect, with a fine and close but irregular sculpture, and clothed with close-lying elongate yellow scales or scale-like setæ, those of the upper surface more elongate and less minute and regularly disposed than those upon the lower surface. The entire upper surface is finely and closely but rather rugosely punctured, with small smooth areas upon the head and pronotum, and several large shallow depressions upon the latter. The pygidium has a narrow, smooth, longitudinal carina along the middle. The legs are slender, the front tibia bearing two small and blunt teeth placed close together at the extremity and a very feeble one above them. The tarsi of the male are a little longer, and upon the front feet a little more dilated, than those of the female.

Stephanopholis rubicundus, sp. n.

Rufus, minute sat disperse flavo-squamosus, modice nitidus, corporis supra squamis minutis, elongatis, subtus paulo latioribus et densioribus; elongatus, fere depressus, capite rugose punctato, clypeo brevi, basi haud contracto, margine antico fere recto; pronoto fortiter sat crebre punctato, lateribus medio angulatis, angulis anticis obtusis, posticis acutis; scutello lato, parce punctato; elytris grosse fere rugose punctatis, singulo 5-costato, costis angustis, valde elevatis, politis; pygidio crebre punctato-rugoso et squamoso; pectore dense fulvo-villoso.

Long. 18.5 mm.; lat. max. 10 mm.

Hab. CEYLON: Bentote.

The only specimen I have seen is a male taken by the late Lord Dormer. It is a smaller and more compact insect than *S. singalensis*, and the scales with which it is clothed are much smaller and less closely set. The clypeus is smaller, more transverse, and not contracted at its base. The sides of the pronotum are less abruptly angulated in the middle and the hind angles are sharp and a little produced. The scutellum is broader and less strongly punctured. The elytra are coarsely punctured, each puncture containing a very minute elongate scale, and there are five sharp smooth costæ upon each, the first bordering the suture. The pygidium is rather closely pitted, each pit containing an oval scale, and the sides of the body beneath are closely clothed with similar but rather larger scales. The metasternal episterna also bear large scales partially covered with long yellow hair, with which the whole of the thorax is clothed beneath.

Stephanopholis cribricollis, sp. n.

Fusco-brunneus, tarsi antennisque rufis, minute et dense fulvo-squamosus; ovatus, convexus, haud nitidus, capite dense rugoso et setoso, fere plano, clypei margine antico recto, reflexo, lateribus arcuatis, basi haud contractis; pronoto dense rugoso, medio paulo grossius, ubique dense squamoso, squamis minutis, elongatis, lateribus post medium angulatis, angulis anticis obtusis, posticis fere rectis, haud acutis, paulo depressis; elytris grosse et confluentur punctatis, paulo minus dense squamosis, leviter trico-statis, parte externo vix costato; pygidio abdomineque subtus dense et minute flavo-squamosis, pectore longe fulvo-hirto.

Long. 19 mm.; lat. max. 9 mm.

Hab. CEYLON: Udugama (Dec., *E. E. Green*).

The unique type is a male presented by the Colombo Museum. A female specimen taken several years previously in the same locality probably belongs to the same species, but differs in the shape of the scales and other important features.

It is a more densely sculptured species than *S. singalensis* and *rubicundus*, and the clothing of scales is also denser, especially upon the pronotum. These are much smaller than those of *S. singalensis*, but are similar in size and shape to those of *S. rubicundus*. The elytral costæ are less narrow and prominent than in the two species mentioned. They consist of three well-marked dorsal ones—the first bordering the suture—and two very faint lateral ones. The legs, claws, and antennæ are similar in all three species. The clypeus is not narrowed at the base, as in *S. singalensis*. The pronotum is very finely and closely rugose and quite opaque, with the front angles obtuse but well marked, and the hind angles rectangular but blunt.

Holotrichia disparilis, sp. n.

Læte ferruginea, capite fusco; elongata, convexa, supra nitida, capite grosse punctato, vertice rugoso, clypeo arcuato, vix perspicue inciso; pronoto fortiter haud crebre punctato, lateribus medio fortiter angulatis antice paulo explanatis, minute crenulatis, angulis anticis paulo productis; scutello utrinque minute punctato; elytris fortiter sat æqualiter punctatis, singulo costa suturali distincta et tribus discoidalibus parum distinctis prædito, partibus apicalibus et lateralibus densius punctatis; pygidio undique dense punctato; pectore longe et dense pallide piloso:

♂, pedibus paulo gracilioribus:

♀, elytris apicem versus grosse rugosis.

Long. 18–21 mm.; lat. max. 9–10 mm.

Hab. CEYLON: Kalupahani, Haldummulle, Kelani Valley, near Colombo (*W. Braine*); Udapursellawa (April, *E. E. Green*); Hewaheta (March, *E. E. Green*).

Although similar in its general form and nearly related to *H. reynaudi*, Bl., this species has a very different appearance, due to its shining upper surface and closer puncturation. It is most markedly separated from other known species by the curious coarsely rugose area near the end of the elytra, but this is peculiar to the female.

As the names of all but one of the four species of

Microtrichia in Brenske's table are incorrect, the following one may be substituted :—

- | | |
|--|--------------------------------|
| 1 (2). Elytra not setose | <i>singhalensis</i> , Brenske. |
| 2 (1). Elytra setose. | |
| 3 (4). Body clothed with soft hair beneath | <i>furcifer</i> , Arrow. |
| 4 (3). Body without soft hair. | |
| 5 (6). Upper surface slightly shining | <i>eurystoma</i> , Burm. |
| 6 (5). Upper surface not shining, very densely
punctured..... | <i>costata</i> , Walk. |

IDIOCHELYNA, gen. nov.

Corpus elongatum, paulo depressum. Pedes modice longi; tarsi parum graciles, quam tibiae vix longiores; ungues simplices. Antennæ 8-articulatæ, clava 5-articulata, elongata. Clypeus angustus, subcircularis, basi leviter constricto, margine fortiter reflexo. Labrum acuminatum, ad clypeum connatum. Mandibulæ obsoletæ. Maxillæ degeneratæ, palpis gracilibus, 4-articulatis, articulo ultimo longo. Labium parvum, digitiforme, palpis contiguis, biarticulatis, articulo ultimo longissimo, recto. Abdomen subtus haud solidum, paulo arcuatum.

Femina ignota.

This genus is constituted for "*Isonychus*" *pectoralis* of Walker, a very peculiar insect without near affinity to any known Oriental genus. It belongs to the curious group in which the biting-parts of the mouth have completely degenerated, and the nearest related forms known to me are *Pachycolus* and *Perissosoma*, of the Madagascar region. As is the case with those, only the male is known. The legs are fairly long, but the tarsi are scarcely longer than the tibiae and the claws are quite simple. The antennæ consist of only eight joints, the three basal ones short and stout, and the remaining five forming a long club to which the footstalk is attached at about a third of its length. Mandibles are practically absent, and the maxillæ merely form bases for the long straight palpi, of which the last joint is as long as the other three together. The labium forms a long finger-like process, with its palpi close together and consisting of a short basal joint and a terminal one about four times as long.

Several specimens of this were taken by Mr. E. E. Green at Hakgala in September.

L.—A new Bamboo-Rat from Perak.
By OLDFIELD THOMAS.

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IN 1902 the British Museum received from Mr. L. Wray, of the Perak Museum, a specimen with skull of a bamboo-rat, referred at the time to *Rhizomys pruinosus*, from Bukit Gantang, Larut. An example of the ordinary Malay bamboo-rat of the genus *Nyctocleptes* was also sent with the same consignment.

In writing my notes on bamboo-rats last year*, I ignored the Perak *Rhizomys*, because of a doubt as to its having its proper skull; but now Mr. H. C. Robinson, in connection with his general work on Malayan mammals, has asked me to examine and report on this specimen, as being the only Malayan *Rhizomys* (s. s.) on record.

The skull is unfortunately in a very bad condition, but, so far as it shows any definite characters, it agrees with that of *Nyctocleptes* rather than *Rhizomys*, while the skin is clearly referable to the latter genus. I am disposed to believe, therefore, that when the specimen was stuffed, as it had been in Perak, the local taxidermist had inserted in the skin a skull of *Nyctocleptes*, common enough in that region.

The skin, however, shows by itself such characters as indicate that the species is new. It may be called

Rhizomys umbriceps, sp. n.

Most nearly related to the *R. pannosus* of South-eastern Siam, with which it shares the harsh poor fur, the general colour, and the absence of the distinctive hoary appearance found in *R. pruinosus* and *senex*. Body-colour nearly as in *pruinosus*, more or less greyish drab, the underfur light grey, the longer hairs brown, some of them tipped with white. But the head, instead of being concolor with the body or very slightly darker, is heavily washed with blackish on crown and cheeks, the top of the muzzle alone rather lighter. Under surface slightly lighter than upper. Hands and feet grey. Tail naked, brown.

* Ann. & Mag. Nat. Hist. (8) xvi. pp. 56 & 313 (1915).

Approximate dimensions (measured on skin) :—

Head and body 340 mm. ; tail 90 ; hind foot 50.

Hab. (of type). Bukit Gantang, Larut, Perak.

Type. Adult male. B.M. no. 2. 5. 2. 4. Presented by the Perak Museum.

That this animal should be distinguishable from the related forms in Burma and South-eastern Siam is only natural, as its locality is so widely distant from theirs, down in the southern part of the Malay Peninsula.

LI.—*A new Form of Delias from Rossel Island.*

By J. J. JOICEY, F.L.S., F.E.S., and G. TALBOT, F.E.S.

Delias ornythion rosselana, subsp. n.

♂. The hind wing below has a thicker red line than in the typical form, and in some specimens it is twice as thick.

♀. This only differs in the more regular edge of the white area on the fore wing. The red line on the hind wing tends to be thicker than in the male.

Described from a series of 16 ♂♂, 2 ♀♀, from Mt. Rossel, 2100 ft., Rossel Island, Nov.–Dec. 1915 (*W. F. Eichhorn*).

On Waigeu and throughout Dutch New Guinea is found the race *Persephone*, Stgr., with the completely black hind wing showing rarely a vestige of a red line. In German and British New Guinea as far east as St. Aignan occurs typical *Ornythion* with a complete red line on the hind wing, which is only rarely vestigial. Rossel Island is the farthest east of the Louisiade group, to which St. Aignan belongs, and here we find the tendency for the red line to increase in size.

Two other *Delias* are known from this island—*maga*, Gr.-Sm., which is a race of *mysis*, Fbr., and *irma*, Fruh., being the Brit. N. Guinea race of *aruna*, Bdv. *D. maga* was described from Sudest Island, also one of the Louisiades, but the specimens from Rossel show a narrower black margin to the hind wing below as compared with the type. We refrain from differentiating this form in the absence of more material from the typical locality, the ♂ type alone being represented in the collection.

BIBLIOGRAPHICAL NOTICES.

The British Museum Catalogue of Ungulate Mammals.

By the death of the late Richard Lydekker systematic zoology suffered a great blow, for his knowledge in this province was profound, based as it was on a wide and deep palæontological foundation. More especially, he excelled in his knowledge of the reptiles and the mammals. The British Museum was therefore fortunate in being able to secure his services when it was decided to issue a Catalogue of the Ungulate Mammals in the Museum. Unhappily, however, death claimed him before he had completed his task, for the fifth and last volume yet remains to be written. The fourth, now under review, was completed only a few days before his death. This includes the deer, chevrotains, camels and llamas, pigs and peccaries, and the hippopotamuses, and represents an immense amount of hard work and no little restraint; for he conceded much to present-day demands, both in the matter of nomenclature and of species "splitting"—though under protest, which he records in his preface. We can sympathize with him when we come to realize that by the present standards of specific distinctions no less than six and twenty subspecies of the Virginian deer (*Odocoileus virginianus*) are now recognized, and of the chevrotain (*Tragulus javanicus*) there are twenty-three variants. A considerable number of these are unrepresented in the Museum collection, but he did well, nevertheless, to include them in this Catalogue.

In the matter of illustrations it must be admitted much is left to be desired. Their selection apparently depended not so much on the requirements of the work as upon the sources from which they could be obtained ready made. Hence it is that some, as in the case of the Persian fallow deer, fail to bring out the really distinctive characters of the species; while in the case of many other species no figures at all are given, evidently because there were no published figures available. These should have been specially prepared for a work of such importance. For this, however, he can hardly be held responsible. In spite of these small blemishes, this volume is in every way worthy of its predecessors, and will prove of immense value to students as well as to the Museum.

Records of the Indian Museum.—Vol. VIII. *Zoological Results of the Abor Expedition.* Part IX., 1916.

THE military results of the punitive force which entered the Abor country in 1911–12 have long since been digested and filed. The scientific results of that expedition, naturally, could not be so speedily estimated. In the 'Records of the Indian Museum' above referred to Col. Godwin-Austen gives the results of his study of the slug-like Mollusca collected by Mr. Stanley Kemp, who was attached to that expedition as naturalist.

Owing to the thorough and systematic way in which Mr. Kemp worked, remarks the author, the very large number of species collected is surprising, and as a series they differ much from what has been hitherto collected on the south face of the Himalayas. Many of these species owe their place in this collection to the initiative of Mr. Kemp, who hit upon the original idea of searching behind the overlapping leaves of the plantain. Col. Godwin-Austen suggests that some of the species thus obtained should be searched for in like positions farther to the west of the Abor Hills, also to the south of the Brahmaputra valley.

Mr. Kemp fortunately made full and very careful notes of the coloration of these slugs, which in many cases were very brilliant; but under the circumstances attending their capture we are not surprised to find that no notes could be taken as to the relation of these colours to their environment. The author's specific descriptions are supplemented by some admirable photographs and a considerable number of figures of dissections.

To the same issue of the 'Records' Dr. Walter Collinge contributes a short paper on the terrestrial Isopoda. Herein he describes one species new to science, for which he has found it necessary to make a new genus—*Rotungus pictus*. He also describes a new species of the genus *Cubaris*—*C. marmoratus*.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

June 23th, 1916.—Dr. Alfred Harker, F.R.S., President,
in the Chair.

The following communication was read:—

'On a New Species of *Edestus* from the Upper Carboniferous of Yorkshire.' By A. Smith Woodward, LL.D., F.R.S., V.P.G.S. With a Geological Appendix by John Pringle, F.G.S.

The new fossil described confirms the interpretation of *Edestus* as a row of symphysial teeth of an Elasmobranch fish. The row of eight bilaterally-symmetrical teeth, fused together, occurs at the tapering end of a pair of calcified cartilages, which evidently represent a jaw. An imperfect detached tooth probably belongs to an opposing row. All the teeth are unusually large compared with their base, and the serrated edges of most of them have clearly been worn during life. As in the case of the American Carboniferous *Edestus mirus*, small Orodont teeth of the form named *Campodus* are scattered in the shale near the jaw. Markings on the *Edestus*-teeth themselves suggest that they have been derived from the *Campodus*-type of tooth. The specimen, which represents a new species, was obtained by Mr. H. H. Freer from shale below the Rough Rock, in the upper part of the Millstone Grit, at Brockholes, near Huddersfield, and was presented to the Museum of Practical Geology by Mr. E. Crowther.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[EIGHTH SERIES.]

No. 108. DECEMBER 1916.

LII.—On new Neotropical Curculionidæ.

By GUY A. K. MARSHALL, D.Sc.

THE types of all the new species described in this paper are in the British Museum.

Subfamily BRACHYDERINÆ.

Diaprepes balloui, sp. n.

Colour shining red-brown; the head and thorax with small scattered pale scales; the elytra (in the ♂) with a broad sublateral stripe of dense yellowish scales, lying for the most part between striæ 5 and 6, and gradually curving inwards behind so as to reach the suture at the top of the declivity; below the shoulder a similar broad stripe, which ceases before the middle; in the ♀ these markings are somewhat reduced and less sharply defined, merging outwardly into indefinite sparse grey scaling; a narrow stripe of broad pale scales on the outer lobe of the mesosternum and along the edge of the metasternum, but in neither case does it extend on to the side-pieces.

♂ ♀. *Head* not transversely impressed, smooth, with scattered punctures; the forehead narrow, less than half the greatest width of the rostrum, with a distinct central stria; the eyes large, depressed, their length greater than the width of the rostrum at the base. *Rostrum* elongate, longer than the head and twice as long as its own basal width; the upper surface smooth and convex, with rather large separated

punctures, each containing a flat scale or a short recumbent seta, and with a slightly raised smooth central line. *Antennæ* with the scape rather abruptly clavate; the funicle with joint 2 half as long again as 1, the remaining joints much longer than broad, each one only slightly widening to its apex, joint 3 rather longer than 4, 4 to 7 subequal and each about as long as joint 2 of the club; the club with joint 1 longer than 2 and about as long as 3+4. *Prothorax* broader than long, its sides regularly rounded, broadest about the middle, with a well-marked subapical constriction, the base shallowly bisinuate and its margin distinctly raised; the upper surface rugose, with low confluent shiny granules, the median area of the disk slightly flattened longitudinally, and sometimes with a trace of a central stria; the scales sparse, small and narrow, the setæ very short and recumbent. *Scutellum* subquadrate, clothed with dense scaling. *Elytra* elongate in the ♂ and gradually narrowed posteriorly from the shoulders; broader in the ♀ and parallel-sided from the shoulders to beyond the middle; the base truncate, the apices each with a short divergent point, the shoulders roundly rectangular; with 13 regular shallow striæ, containing large quadrate punctures, the sixth stria extending only from the base to somewhat behind the middle and almost obscured by the scaling, the ninth and tenth arising at some distance behind the shoulder; the intervals all of equal height, much narrower than the striæ, and bearing a few minute punctures; in the two stripes the large rounded scales are densely packed, and among them are numerous broad, short, curved, scale-like setæ; the rest of the surface is thinly clothed with minute narrow scales or recumbent setæ, with a few larger scales in some of the punctures. *Legs* long and slender, red-brown, thinly clothed with very small scales.

Length 9–10½, breadth 3½–4 mm.

LESSER ANTILLES: Dominica (*H. A. Ballou*).

This species is the representative in Dominica of *D. hemigrammus*, Chev. (Natural. 1880, p. 197), which occurs in Martinique. The latter insect differs in the following particulars:—The rostrum is more strongly punctate and the central line is more raised in the anterior half; the eyes are rather more convex and the forehead is a little broader proportionately; the prothorax is broader, more finely and closely granulate, and the sides are more strongly rounded; on the elytra the discal stripe does not curve in to the suture, but stops at the top of the declivity, with its inner edge covering the third stria; the stripe is also nearer the suture,

there being only three clear striæ between them in the basal half, whereas in *D. balloui* there are four; the shoulders are rather more sloping, and between the tenth and eleventh striæ there is, behind the middle, a short intercalated row of six to eight punctures; finally, in *D. balloui* the spatula of the male ædeagus is rather shorter and appreciably more pointed.

Diaprepes famelicus barbadensis, subsp. n.

A distinctly larger and stouter insect than *D. famelicus*, Oliv., and of a uniform leaden-black colour, the clothing of the elytra consisting of short, narrow, curved, dark scales, which are dense along the lateral margins and apex and more sparse on the disk.

The structural differences from *D. famelicus* are as follows:—The sculpturing of the prothorax is finer and smoother, there being no granules on the disk. The scutellum is distinctly transverse, whereas in *D. famelicus* it is nearly as long as broad and subpentagonal. On the elytra the sutural margin is narrowly impressed; the intervals are less carinate laterally, and at the extreme base the intervals 3 and 5 are not appreciably higher and broader than those adjoining them; just beyond the fifth stria is a longitudinal area in which the punctures are very irregular. But the most striking character by which this form may be distinguished from *D. famelicus* and its other subspecies is the complete absence of the usual round flat scales.

Length 12–16, breadth 5–9 mm.

LESSER ANTILLES: Barbados, on *Agave americana* (J. R. Bovell, H. A. Ballou).

In a recent paper on *Diaprepes* (Journ. Agric. Research. Wash. iv., June 1915, p. 263) Mr. W. Dwight Pierce treats *D. esuriens*, Gyl., as a mere synonym of *D. famelicus*. This course seems inadvisable, as it obscures the difference in their geographical distribution. *D. famelicus* was originally described from Guadeloupe, and specimens from that island can be distinguished by certain minor characters from examples which I have seen from Antigua, Montserrat, and St. Kitts. These agree well with the type of *D. esuriens* from St. Bartholomew, with which I compared them when in Stockholm in 1913. The characters by which these two forms may be distinguished are as follows:—

D. famelicus.—Eyes rather less convex. Elytra with the intervals rather more costate, owing to the transverse spaces between the punctures being on a slightly lower level; the alternate dorsal intervals very slightly more raised than the

others, especially behind and towards the sides; the scaling less dense, the round flat scales being confined to the punctures except along the extreme lateral margins; the round scales pale, with a faint metallic greenish reflection, and often dusted with yellow powdering.

D. famelicus esuriens.—Eyes rather more convex. Elytra with the intervals rather broader and flatter, and all of equal height; the scaling much denser, especially towards the sides and apex; the round scales occurring equally on the intervals and in the punctures, generally dull, of a light brown or brownish-grey colour, rarely with a slight coppery reflection, but never with yellow powdering; in general effect the posterior half of the elytra appears much smoother and less strongly punctured. The specimen figured by Mr. Pierce (pl. xxxvi. fig. 2) evidently belongs to this form.

Further south, in Martinique, we find another very distinct race—*D. famelicus elegantulus*, Gyl.,—in which the carination of the elytra is still more marked, the alternate intervals being strongly raised and quite bare, while the intervening spaces are densely clothed with pale metallic green scaling and yellow powdering.

It is interesting to note that the Barbados form is very distinct from that occurring in the nearest of these islands, namely, Martinique, being most nearly allied to the form that is geographically most remote (*esuriens*). It therefore seems probable that the Barbados stock was originally introduced from the northern islands.

In the same paper Mr. Pierce deals with some of the many forms of the variable and economically important *Diaprepes abbreviatus*, L. He says:—"Merely for the convenience of designation and to retain old well-known names, the species *Diaprepes spengleri* has been arbitrarily arranged into varieties by the writer." Unfortunately the old names employed in this arbitrary arrangement appear to have been applied without any particular regard to the sense in which they were used by their original authors. Such a method must inevitably lead to confusion, and, pending an adequate revision of this difficult genus, it seems desirable to indicate without further delay the correct names of the forms figured by Mr. Pierce (l. c. pls. xxxv. & xxxvi.).

In the first place, the specific name *abbreviatus* is erroneously attributed to Olivier, the real author being Linnæus (1764), and the name having two years' priority over *spengleri*, L. (1776). The primary specific name applicable to all the varieties is therefore *abbreviatus*, and not *spengleri*.

The form to which the name *marginatus*, Oliv., is applied

bears no resemblance to Olivier's insect, and is undoubtedly *farinosus*, Gyl., which is possibly a synonym of *rohrii*, F.; it does not yet appear certain that this form is really conspecific with *abbreviatus*.

The variety figured as *comma*, Boh., is *doublieri*, Guér.; the true *comma* occurs in Venezuela and Trinidad, and I have not so far seen any specimens from the Antilles.

The figure attributed to *abbreviatus* must not be regarded as typical of the species, for it does not agree satisfactorily with Linnaeus's description; his type (from Martinique) is at Upsala, but I have not yet had an opportunity of examining it.

The form described as a new variety, *denudatus*, Pierce, is the true *marginatus*, Oliv., recorded only from Guadeloupe.

Pachnæus citri, sp. n.

Colour piceous, with uniform, dense, pale bluish-green scaling, the glitter of which is more or less obscured by a sparse dusting of pale yellow powder; this powder is more conspicuous at the sides and base of the prothorax, along the lateral margins of the elytra, and in the punctures.

♂ ♀. *Head* with dense opalescent creamy scales, with a broad, subcostate, bare central stripe, which extends backwards well beyond the eyes and bears a large round fovea at the narrowest part of the forehead; the eyes closer together than usual. *Rostrum* longer than broad, the genæ slightly rounded, the dorsal outline flat from the forehead to about the middle of the rostrum, then sloping gently to the apex; the dorsum with a bare punctate central costa and a slight depression on each side of it, bounded outwardly by a more or less distinct narrower lateral costa, the space between the apices of the scrobes as broad as the narrowest part of the forehead; the basal half of the dorsum and the forehead bear numerous long, recumbent, scale-like setæ in addition to the scaling. *Antennæ* with joints 1 and 2 of the funicle subequal, 3 much longer than 4, 4 to 7 of about equal length and evidently longer than broad; the club much narrower than usual. *Prothorax* a little shorter than the basal width, broadest at the base, very slightly narrowing to beyond the middle, and then more abruptly so (♀), or more nearly parallel-sided (♂), the basal margin rather shallowly bisinuate, the apical margin rounded dorsally, its gular edge very deeply sinuate; the upper surface moderately convex, slightly flattened in the middle of the basal area, with a fine central furrow reaching neither the base nor apex and usually obliterated in the middle; the sculpturing entirely hidden by

the scaling, and consisting of shallow, closely set punctures; a single pair of punctures shows through the scaling in the middle of the disk, and sometimes a more distant pair behind the middle. *Elytra* with the basal margin simple and almost straight; those of the ♀ broad, almost parallel-sided to beyond the middle, rather sharply acuminate behind and separately pointed; those of the ♂ narrower, much less acute behind and jointly rounded at the apex; very shallowly punctate-striate, the number of the striæ being 14, owing to the intercalation of two striæ between the normal fourth and fifth or fifth and sixth, the additional striæ uniting and ceasing a little behind the middle; the intervals flat, with coriaceous sculpturing, which is quite hidden by the scaling, and with short, recumbent, flattened, white setæ.

Length, ♂ 8, ♀ 10–11 mm.; breadth, ♂ $3\frac{1}{2}$, ♀ $4\frac{3}{4}$ – $5\frac{1}{2}$ mm.

JAMAICA (*A. H. Ritchie*).

P. opalescens, Oliv., *P. litus*, Germ., and *P. azurescens*, Gyl., may all be distinguished from this species by the fact that they have the base of each elytron distinctly lobed and the external angle projecting forwards. Of the remaining described species, *P. distans*, Horn, is the nearest ally to *P. citri*, but differs as follows:—The rostrum, as seen laterally, is deeper, its dorsal outline being strongly convex; the gular emargination of the prosternum is very much shallower; the elytra are narrower and have only 12 striæ. *P. psittacus*, Oliv., differs in having the space between the apices of the scrobes markedly narrower than the forehead, the distal joints of the funicle not longer than broad, &c.

Mr. Ritchie states that this species was found on citrus-trees.

Pachnæus marmoratus, sp. n.

♀. Colour piceous, with creamy-white scaling variegated with glittering pale green markings as follows:—The prothorax with two broad oblique discal stripes, which unite broadly in front; the elytra with five or six narrow, extremely irregular or broken, transverse bands, and a narrow sutural and broader lateral stripe; the head, rostrum, and legs with metallic coppery scaling.

Head with the vertex rather prominent, the forehead with a bare median costa extending behind the eyes and bearing a large central fovea. *Rostrum* longer than broad, parallel-sided, the dorsal outline as in *P. citri*, but the depth proportionately less; the dorsum with a bare impunctate costa and a shallow longitudinal impression on each side of it, but no lateral costa, the space between the apices of the scrobes as

broad as the narrowest part of the forehead; the scaling dense, except in the area above the scrobe, the recumbent setæ scarcely distinguishable from the scaling. *Antennæ* as in *P. citri*. *Prothorax* evidently broader than long, almost parallel-sided from the base to the middle, then rapidly narrowing to the apex and with a shallow subapical constriction, the basal margin strongly bisinuate, the apical margin truncate dorsally and with no trace of a gular sinuation; the upper surface with a broad shallow pear-shaped impression in the middle of the disk, extending from the base almost to the front margin and containing in its anterior half traces of an interrupted central stria; the close shallow punctation almost entirely hidden by the scaling. *Elytra* moderately broad, very slightly sinuate behind the shoulders, which form a rounded obtuse angle, shortly pointed behind; striato-punctate, with 14 rows, the intercalated ones being between the normal fifth and sixth, and extending only from behind the shoulders to a little behind the middle; the punctures for the most part not completely covered and each containing a minute scale; the white scales very dense and overlapping, the green ones rather more sparse, the setæ short and recumbent. *Legs* with the front tibiæ much more strongly curved than usual and with a very long apical mucro.

Length 11–15, breadth $4\frac{1}{2}$ – $6\frac{1}{2}$ mm.

JAMAICA: Bath (*Mrs. E. M. Swainson*).

This beautiful insect differs from all the previously described species in its coloration, the structure of the front tibiæ, and the absence of the gular sinuation of the prothorax.

One of the specimens was found on a yam-plant.

Eustylus obliquefasciatus, sp. n.

Colour piceous, the upper surface with brown scaling variegated with paler markings, the underparts uniform greyish white; the pronotum with two broad, discal, pale brown stripes, diverging behind and continued for a short distance on interval 3 of the elytra, and a narrower lateral stripe; elytra with interval 1 paler and the two external intervals whitish from before the middle to the apex, and with the following whitish markings (usually edged with dark brown):—A spot on the front of the shoulder; an oblique row before the middle of three spots on intervals 7, 5, and 3, the outermost nearest the base; behind and parallel with this a very irregular oblique band running from the middle of the lateral margin to the suture at the top of the

declivity, which may be broken up into two or more patches; and, finally, three contiguous spots at the apex of intervals 3, 5, and 7.

♀. *Head* with the front margin of the ocular orbit deeply impressed, the width of the forehead a little greater than the length of the eyes, which are not very prominent, the forehead level with the vertex. *Rostrum* longer than broad, the sides parallel from the base to the middle, the genæ strongly dilated, the inter-scorbal area much less widened than usual, its margins almost straight, the scrobe distinctly longer than the space between the scrobe and the eye, the median dorsal area almost flat as far as the apical slope. *Antennæ* with the scape subcylindrical and rather strongly curved, the setæ obliquely raised; the funicle with joint 2 much longer than 1, 3 a little longer than 4, 4 to 7 subequal; the club comparatively large, as long as the three preceding joints. *Prothorax* about as long as broad, the sides subparallel from the base to the middle, thence gradually narrowed to the apex, the subapical constriction very slight; the upper surface apparently quite smooth, no trace of the sculpture being appreciable through the scaling. *Scutellum* subquadrate, slightly elevated. *Elytra* distinctly broader proportionately than in the other species, the basal margin jointly sinuate, the apices obtuse and slightly separate, the humeral slope running straight to the basal angle, the sides slightly sinuate behind the shoulders and somewhat widened behind the middle; the upper surface slightly flattened in the middle of the disk, the shallow sulci containing remote punctures, which are not entirely filled up by the scaling; all the intervals costate, especially in the posterior half, 3, 5, and 7 being distinctly more raised than the others; the setæ for the most part dark and recumbent, forming a single row on the lower intervals, and more numerous on the higher, the longitudinal space between them being usually little greater than the length of the setæ. *Legs* with pale scaling and a dark pre-apical spot on the posterior pairs of femora; the front femora with a very small tooth.

Length 9-10, breadth $4\frac{1}{2}$ -5 mm.

VENEZUELA.

Eustylus bodkini, sp. n.

Colour black, with chalky-white scaling; the prothorax with three broad, pale brown stripes; the elytra with a narrow, common, V-shaped, brown mark at the top of the declivity, distinct as far as interval 3, thence much more faint and bent forwards for a short distance along interval 5.

♀. *Head* with a faint transverse impression behind the eyes, which are moderately prominent, the front portion of the orbit only shallowly impressed, the width of the narrowest part of the forehead equal to the length of the eye. *Rostrum* parallel-sided in the basal half, then strongly dilated, the margins of the inter-scorbal area gently curved, the scrobe a little longer than the space between it and the eye, the median dorsal area quite flat as far as the apical slope. *Antennæ* with the scape broad, compressed and rather strongly curved, the setæ curved and slightly raised; the funicle with joint 2 much longer than 1, which is scarcely longer than 3, 3 a little longer than 4, 4 to 7 subequal; the club only as long as the two preceding joints. *Prothorax* about as long as broad, parallel-sided from the base to the middle, then gradually narrowing to the apex, the subapical constriction shallow, the front margin slightly rounded dorsally; the upper surface with slight inequalities appreciable through the scaling on the disk, these being more evident towards the sides. *Scutellum* a little longer than broad, oblong. *Elytra* of the usual rather elongate form, the basal margin straight from the outer angle to interval 3 and jointly sinuate in the middle, the apical area rather sharply pointed, the apices themselves slightly separated; the humeral slope not running straight to the basal angle, but forming a distinct angle with the base; the shallow sulci containing large, widely separated punctures, which are much more exposed than usual, each having a small projecting scale on the front edge; intervals 3, 5, and 7 strongly costate, the others almost flat, except interval 1, which is costate on the declivity only, being there higher than 3; the setæ pale, moderately long and recumbent or nearly so, forming a single row on the low intervals, irregular and more numerous on the raised areas. *Legs* pale sandy, the front femora with a strong tooth.

Length $9-9\frac{1}{2}$, breadth $3\frac{1}{2}-3\frac{3}{4}$ mm.

BRITISH GUIANA: Issororo, North-west District (*G. E. Bodkin*).

Eustylus subvittatus, sp. n.

Colour black, with dirty white scaling and faint light brown markings; the prothorax with three broad stripes; the elytra with faint stripes on the lower intervals, especially in the basal half, and an oblique stripe running from before the middle on stria 5 to the suture at the top of the declivity.

♂ ♀. *Head* not transversely impressed, the eyes not very prominent, their length a little less than the width of the forehead. *Rostrum* as in *E. bodkini*. *Antennæ* very similar

to those of *E. bodkini*, but the scape is but little curved, and the setæ are finer, shorter, and straighter; the club is larger and as long as the three preceding joints. *Prothorax* as in *E. bodkini*, except that the front margin is truncate and not rounded. *Scutellum* strongly exserted, subquadrate. *Elytra* elongate, subtruncate at the base, the apical area somewhat produced, the apices separately pointed, the humeral slope forming an angle with the base; the punctures in the sulci are closely placed, nearly twice as numerous as in *E. bodkini*, entirely covered with scaling, but not obliterated; the alternate intervals distinctly raised, the setæ very short and quite recumbent. *Legs* with uniform pale sandy scaling; the front femora angulated, but without a distinct tooth.

Length 8-9½, breadth 2¾-3½ mm.

VENEZUELA: Caraccas.

Chevrolat's MS. name has been retained for this species.

Eustylus ephippiatus, sp. n.

Colour black, with dense chalky-white scaling and light brown markings; prothorax with a light brown lateral stripe, which is quite indefinite on its lower side, but has a sharp, darker brown, emarginate edge above, thus enclosing a hexagonal discal whitish area, in which brownish scales are mingled, especially along the front margin; elytra with an irregular humeral brown patch extending for about one-fourth the length and lying between striæ 2 and 7, pale and ill-defined in front, and with a darker dentate edge behind; beyond the middle a broad common transverse band, extending to stria 7 and darker and dentate on both edges; and, finally, an irregular apical patch, ill-defined behind and with a darker dentate edge in front.

♀. *Head* scarcely impressed behind the eyes, which are moderately prominent, the width of the forehead only very little greater than the length of the eye. *Rostrum* rather stout, parallel-sided in the basal half, the genæ strongly dilated, the epistome much less raised than usual, being far lower than the inner edge of the scrobe, the apical slope more abrupt and steep than usual, the length of the scrobe about equal to the space between it and the eye. *Antennæ* with the scaling brown on the scape and grey on the funicle; the scape somewhat compressed and gently curved, the setæ recumbent; the funicle with joint 2 evidently longer than 1, 3 about equal to 7 and a little longer than 4, 4 to 7 subequal, elongate and gradually dilated from base to apex; the club rather longer than the two preceding joints. *Prothorax* as

long as broad, parallel-sided from the base to the middle, then rather strongly narrowed, the subapical constriction shallow; the upper surface apparently quite smooth, the sculpture being entirely hidden by the scaling. *Scutellum* subquadrate, elevated. *Elytra* with the sides shallowly sinuate behind the shoulders and somewhat rounded beyond the middle, the basal margin jointly trisinate, the apical area not much produced, the apices not pointed and scarcely separated, the humeral slope forming a distinct angle with the base; upper surface with a shallow transverse impression close to the base, the shallow sulci with large remote punctures which are not entirely covered by the scaling, the alternate intervals strongly raised, the others only slightly convex, interval 1 as high as 3 at the top of the declivity; the setæ inconspicuous, very short and broad, and quite recumbent. *Legs* with dirty white scaling, the front tibiæ brownish; the front femora without a tooth.

Length $12\frac{1}{2}$, breadth $5\frac{1}{4}$ mm.

COLOMBIA.

This is the largest species of *Eustylus* as yet described, and is allied to the variable West-Indian *E. hybridus*, Rosen., in which the brown pattern, when present, is very similar. The latter species differs, however, in having the two basal joints of the funicle equal, while joints 3 to 6 are cylindrical; the rostrum is less dilated in front and the apical slope is less abrupt; the rugose sculpturing of the prothorax is distinctly appreciable through the scaling, and the alternate intervals of the elytra are much less strongly raised.

Eustylus simulatus, sp. n.

Colour black, with dense uniform brownish-grey scaling.

♀. *Head* with a shallow transverse impression behind the eyes, which are rather small and not very prominent, the width of the forehead evidently greater than the length of the eye. *Rostrum* gradually widening from the base to the middle, the apical dilatation consequently less abrupt, the median dorsal area flat and parallel-sided, the apical slope gradual, the scrobe longer than the space between it and the eye. *Antennæ* with the scape but slightly compressed, gently curved and with erect setæ; the funicle with the two basal joints subequal, 3, 4, and 7 equal and each a little longer than 5 or 6, which are themselves equal; the club nearly as long as the three preceding joints. *Prothorax* a trifle longer than broad, the sides subparallel from the base to the middle, then narrowed to the apex, the subapical

constriction rather well marked ; the coarse punctation clearly visible through the scaling, and a distinct trace of a shallow central furrow. *Scutellum* longer than broad, narrowing towards the base. *Elytra* narrowly elongate, not sinuate behind the shoulders and scarcely dilated beyond the middle, the basal margin straight except for a median sinuation extending to stria 2 on each side, the humeral slope running straight to the basal angle, the apical area scarcely produced, the posterior declivity consequently steeper than usual, the apices separately rounded ; the shallow sulci with numerous closely set punctures, which are covered but not hidden by the scaling, the alternate intervals distinctly raised, the others almost flat, interval 1 elevated almost as far as the base ; the setæ moderately long, stout, and erect, each interval bearing a single row, but on the raised ones the setæ are doubled here and there. *Legs* with uniform brownish-grey scaling, the front femora obtusely angulated but without any tooth.

Length $9\frac{1}{2}$, breadth 4 mm.

COLOMBIA.

I have retained Chevrolat's MS. name for this species.

Eustylus sordidus, sp. n.

Colour black, with uniform dirty white scaling.

♀. Very similar to *E. simulatus*, but differing as follows :—*Head* with the transverse impression slightly more pronounced, the eyes rather larger, the width of the forehead but little greater than the length of the eye. *Rostrum* parallel-sided in the basal half, the apical dilatation rather more abrupt. *Antennæ* with the scape proportionately shorter ; joint 6 of the funicle not shorter than 7 ; the club only a little longer than the two preceding joints. *Prothorax* parallel-sided to beyond the middle, the subapical constriction somewhat more strongly marked, the disk less convex and with no trace of central furrow. *Elytra* much shorter in proportion to the breadth, the humeral slope forming an angle with the base.

Length 8, breadth $3\frac{3}{4}$ mm.

COLOMBIA.

Eustylus simplex, sp. n.

Colour reddish brown, with uniform dense grey scaling.

♀. *Head* with a marked transverse impression, the width of the forehead rather less than the length of the eye ; the eyes very large and not very prominent, the facets absolutely flat. *Rostrum* parallel-sided in the basal half, the genæ

strongly dilated, the scrobe much longer than the space between it and the eye, the median dorsal area flat. *Antennæ* with the scape slightly curved and somewhat compressed, broadest below the base and gradually narrowing to the apex, the setæ subrecumbent; the funicle with the two basal joints almost equal, 3 a little longer than 4, and 4 to 7 subequal; the club a trifle longer than the two preceding joints. *Prothorax* a little broader than long, the sides gently rounded, broadest at the middle, slightly narrowed towards the base and more so to the apex, the subapical constriction broad and distinct; the upper surface foveate and uneven, the foveæ covered and partly obscured by the scaling. *Scutellum* trapezoidal, narrower at the base. *Elytra* rather short and almost parallel-sided, the basal margin deeply sinuate in the vicinity of the scutellum only, the apical area only slightly produced, the apices separately rounded, the humeral slope running direct to the basal angle; the sulci with rather large shallow punctures, which are almost entirely covered but not concealed by the scaling, the intervals comparatively narrow, the alternate ones more raised, interval 1 rather higher than 3 almost down to the base; the setæ rather long and erect, those on the raised intervals forming only a single row. *Legs* with uniform grey scaling, the front femora with a strong tooth.

Length 7, breadth 4 mm.

COLOMBIA.

Eustylus inclusus, sp. n.

Colour black, with dense chalky-white scaling and brown markings; the head and rostrum pale fawn-colour above; the prothorax with a broad brown lateral stripe on each side and a narrower indefinite central one; each elytron with a very broad brown stripe running from the shoulder to the middle between striæ 3 and 7, and then turning obliquely inwards up to the suture at the top of the declivity.

♂ ♀. *Head* scarcely impressed behind the eyes, which are rather large and prominent, the width of the forehead equal to the length of the eye. *Rostrum* almost parallel-sided in the basal half, the genæ strongly dilated, the scrobe about as long as the space between it and the eye, the median dorsal area flat. *Antennæ* with the scape only slightly curved and somewhat compressed, the setæ recumbent; the funicle with the two basal joints equal, 3 distinctly longer than 4, 4 and 5 equal to 7, 6 a little shorter; the club much smaller than usual and scarcely as long as the two preceding joints. *Prothorax* a trifle longer than broad, parallel-sided from the

base to beyond the middle, the subapical constriction shallow, the anterior margin slightly rounded dorsally; the whole upper surface with very coarse punctures, which are covered but not concealed by the scaling. *Scutellum* subquadrate, very prominent. *Elytra* narrow in the ♂, much broader in the ♀, the basal margin jointly sinuate in the middle only, the humeral slope running straight to the basal angle, the apical area but little produced, the apices scarcely separated; the sulci with large shallow distant punctures, which are mostly bare in the centre, with a single scale projecting from the front edge; intervals 1, 3, 5, and 7 distinctly more raised, interval 1 elevated right up to the base and higher than interval 3 at the top of the declivity; the setæ rather long, obliquely raised and forming a single row on each interval. *Legs* with dirty white or sandy scaling, usually with a dark subapical patch on the posterior femora; the front femora with a stout tooth.

Length $7\frac{1}{2}$ –10, breadth $2\frac{3}{4}$ – $4\frac{1}{2}$ mm.

BRAZIL (*H. W. Bates*).

Eustylus subguttatus, sp. n.

Colour black, with dense chalky-white scaling; the head, rostrum, and antennæ light brown or fawn; the prothorax with three very faint and often indistinguishable brownish stripes; the elytra with the following small brown dots, some or all of which may be absent:—one before and another behind the middle on interval 3, and one at the middle on interval 5.

♂ ♀. Structurally very close to *E. inclusus*, but differing as follows:—*Antennæ* with the setæ on the scape much shorter and more slender. *Rostrum* with the scrobes less curved inwards, the space between them distinctly broader. *Scutellum* scarcely elevated. *Elytra* with intervals 3, 5, and 7 more strongly raised, but interval 1 not raised except on the declivity, and there not as high as interval 3; the setæ much shorter, the rows on the higher intervals duplicated; the punctures almost completely covered, but not hidden, by the scaling.

Length 9–11, breadth $3\frac{1}{2}$ – $4\frac{1}{2}$ mm.

BRAZIL: Villa Nova, Amazon R. (*H. W. Bates*).

The Mexican *E. sexguttatus*, Champ., which somewhat resembles the more strongly marked specimens of this species, differs, *inter alia*, in having entirely recumbent setæ, the width of the forehead evidently less than the length of the eye, and a more slender funicle.

Eustylus bolivianus, sp. n.

Colour black, with brown scaling, the elytra with ill-defined darker brown stripes on intervals 2, 4, and 6, these stripes being broken by an irregular oblique band of the ground-colour running from behind the shoulder to the middle of the suture.

♂. *Head* with a shallow transverse impression behind the eyes, which are large and moderately prominent, their length being greater than the width of the forehead. *Rostrum* elongate, parallel-sided in the basal half, the genæ abruptly dilated, the scrobe about as long as the space between it and the eye, the median dorsal area flat. *Antennæ* elongate; the scape comparatively slender and almost cylindrical, gently curved, and with stout recumbent setæ; the funicle with the two basal joints equal, 3 a little longer than 4, the remainder subequal except 6, which is shorter and subquadrate; the club as long as the three preceding joints. *Prothorax* a little longer than broad, subcylindrical, being slightly narrowed only near the apex; the rugose punctures entirely covered, but not hidden, by the scaling, the intervals in the middle bearing a few small shiny granules. *Scutellum* subquadrate, level with the elytra. *Elytra* jointly sinuate throughout at the base, the humeral slope running direct to the basal angle, the sides feebly sinuate behind the shoulders, the apical area not much produced, the apex broadly rounded, the posterior declivity steep, its outline very slightly sinuate; the shallow sulci with rather large ocellated punctures, the alternate intervals only slightly raised; the setæ moderately long and obliquely raised, all the intervals with only a single row. *Legs* with light brownish scaling; the front femora with an obtuse tooth.

Length $7\frac{1}{2}$, breadth 3 mm.

BOLIVIA.

The specimen here described was identified by Jekel as *E. striatus*, Boh., but this superficially similar Mexican species, of which there is a co-type in the British Museum, presents the following differences:—The eyes are entirely lateral; the rostrum is continuously widened from the base, the sides being almost straight; the scrobe is much longer than the space between it and the eye; there is a deep central stria on the forehead and basal half of the rostrum and a short carina at the apex of the rostrum; the cylindrical prothorax is more than half as long again as its basal width; the broad brown setæ of the elytra are entirely recumbent; the outline of the posterior declivity is distinctly angulated, &c.

Eustylus æquus, sp. n.

Colour black, the upper surface with brown scaling variegated with paler and darker markings, the scaling of the lower surface cream-coloured; the prothorax with three ill-defined dark brown stripes; elytra with the lateral margin (from before the middle), an oblique band from the margin to the top of the declivity, and an irregular apical patch cream-coloured or pale fawn; behind the middle an oblique darker brown band lying between striæ 1 and 8, its front half being between striæ 2 and 8 and the posterior half between 1 and 7; the portions of this band on intervals 2 and 4 are blackish, and there are similar dark marks on intervals 2, 4, and 6 in the brown patch on the declivity.

♂ ♀. *Head* not transversely impressed, the width of the forehead equal to or greater than the length of the eye. *Rostrum* parallel-sided in the basal half, the genæ strongly dilated, the scrobe barely as long as the space between it and the eye. *Antennæ* with the scape somewhat compressed and gently curved, the setæ subrecumbent; the funicle with joint 2 very slightly longer than 1, 3 a little longer than 4 and as long as 7, 4 and 5 equal, 6 shorter and subquadrate; the club a little longer than the two preceding joints. *Prothorax* a little longer than broad, the sides subparallel to beyond the middle and gently narrowed in front, the subapical constriction indistinct; the upper surface uneven, the rugose punctation clearly discernible through the scaling. *Scutellum* longer than broad, almost oval. *Elytra* narrow and parallel-sided in the ♂, rather broader and slightly widened behind the middle in the ♀, the basal margin only shallowly sinuate in the middle, the apical area not produced (as seen directly from above), the apices slightly separated, the humeral slope forming a slight angle with the base; the shallow sulci with rather numerous, deep, separated punctures, the centre of each being almost filled by a single scale; all the intervals of practically equal height, and each bearing a single row of rather long, stout, erect setæ, which are rather more numerous than usual. *Legs* brownish grey, the front femora with a strong tooth.

Length $7-8\frac{1}{2}$, breadth $2\frac{1}{2}-3\frac{1}{2}$ mm.

BRAZIL: Nanta, Amazons.

Eustylus scapularis, sp. n.

Colour black, with dense light brown scaling above, variegated with paler and darker markings; the lower surface creamy white; the prothorax with a well-defined broad

dark stripe on each side, and a fainter one below it; the elytra a pale stripe on interval 1 from the base to the middle, and there uniting with a pentagonal pale patch, which extends to stria 3 on each side; this patch is embraced by a broad V-shaped dark mark, having its apex at the top of the declivity and united anteriorly along interval 3 with an ill-defined, oblique, subbasal dark patch; a short pale line behind the shoulders, and a vague pale mark behind the V-shaped patch.

♂. *Head* with a deep transverse impression behind the eyes, which are relatively large and prominent, the width of the forehead distinctly less than the length of the eye. *Rostrum* gradually widening from the base to the middle, the genæ abruptly dilated, the scrobe about equal to the space between it and the eye, the median dorsal area more raised than usual and the lateral slope steeper. *Antennæ* with brown scaling on the scape, the funicle grey, the last joint and the club darker; the scape exceptionally broad, evidently broader than the front tibia, subcompressed and slightly curved, the setæ erect; the funicle with joint 2 scarcely longer than 1, joints 3 to 7 subequal, and the club almost as long as the three preceding joints. *Prothorax* as long as broad, parallel-sided to the middle, the subapical constriction distinct; the upper surface almost flat in the pale central area, and the sculpturing there entirely hidden by the scaling, but on each side of it are two large shallow impressions, one before and the other behind the middle. *Scutellum* almost circular. *Elytra* narrow and parallel-sided, the basal margin shallowly sinuate in the middle, the humeral slope running straight to the basal angle, the apical area only slightly produced, the apices rounded and scarcely separated; the shallow sulci are almost obliterated by the dense suberect scaling, and the dorsal punctures are quite hidden, though those on the inflexed margins are more or less indicated; the intervals 1, 3, 5, and 7 are slightly more raised than the others, and all of them have a single row of long, stout, erect setæ. *Legs* with pale fawn scaling, the front femora with a distinct tooth.

Length 5, breadth $1\frac{1}{2}$ mm.

BRAZIL (*H. W. Bates*).

This insect and *E. æquus* differ from the other species here described in having the scales on the elytra suberect, that being the normal position for the scales on the forehead and rostrum (and usually also on the scape) in this genus.

Mr. G. C. Champion has already published a key to the *Ann. & Mag. N. Hist.* Ser. 8. Vol. xviii.

Central-American species of *Eustylus* (Biol. Cent.-Amer., Ins., Coleopt. iv. pt. 3, 1911, p. 290), and they are therefore not included in the following synoptic table. The three species described from Peru—viz., *E. humilis*, Er., *E. placidus*, Er. (Wieg. Arch. 1847, p. 129), and *E. funicularis*, Kirsch (Berl. ent. Zeit. 1874, p. 390)—are also omitted, as they are unknown to me. Probably some of the species ascribed to the genus *Compsus* would be more suitably placed in *Eustylus*.

- 1 (12). Elytra with recumbent setæ.
- 2 (3). All the intervals of the elytra equally raised; insect with more or less metallic green scaling *puber*, Oliv.
- 3 (2). Alternate intervals of the elytra more raised; no metallic green scaling.
- 4 (7). Front femora toothed.
- 5 (6). Elytra broad, brown, each with two oblique rows of darkish white-edged spots; the humeral slope of the elytra running direct to the basal angle; femoral tooth very small .. *obliquefasciatus*, sp. n.
- 6 (5). Elytra narrow, whitish, with a short common -shaped brown mark behind the middle; the humeral slope forming an angle with the base; femoral tooth well developed *bodkini*, sp. n.
- 7 (4). Front femora not toothed.
- 8 (11). Funicle with joint 2 evidently longer than 1.
- 9 (10). Epistome elevated, as high as the inner edge of the scrobe; elytra dirty white, with very faint brownish stripes .. *subvittatus*, sp. n.
- 10 (9). Epistome depressed, much lower than the inner edge of the scrobe; elytra chalky white, with brown markings: an irregular humeral and a common apical patch, and a broad dentate transverse band behind the middle .. *ephippiatus*, sp. n.
- 11 (8). Funicle with the two basal joints equal. *hybridus*, Rosen.
- 12 (1). Elytra with erect setæ; funicle with the two basal joints equal or subequal.
- 13 (26). Elytra with a transverse basal impression, the upper edge of the basal margin projecting strongly forwards.
- 14 (17). Front femora not toothed.
- 15 (16). Rostrum gradually dilated from the base to the genæ, so that the sides are almost straight; humeral slope of the elytra running direct to the basal angle..... *simulatus*, sp. n.
- 16 (15). Rostrum parallel-sided in the basal half, the genæ more abruptly dilated,

- so that the sides appear deeply sinuated; humeral slope forming an angle with the base *sordidus*, sp. n.
- 17 (14). Front femora with a more or less distinct tooth.
- 18 (19). Prothorax a little broader than long, the sides gently rounded in the middle; head distinctly impressed behind the eyes *simplex*, sp. n.
- 19 (18). Prothorax slightly longer than broad, the sides straight from the base to beyond the middle.
- 20 (25). Elytra with the dorsal punctures plainly visible through the scaling; the scape not broader than the middle of the front tibiæ; the prothorax without dorsal impressions.
- 21 (24). Elytra with the alternate intervals distinctly more raised.
- 22 (23). Interval 1 of the elytra raised throughout and much higher than interval 3 at the top of the declivity, when seen in profile; each elytron with a broad dark stripe from the shoulder to the middle, then bent in to the suture . . *inclusus*, sp. n.
- 23 (22). Interval 1 of the elytra not raised except on the declivity, and there scarcely as high as interval 3; elytra whitish or pale sandy, usually with a few brown spots *subguttatus*, sp. n.
- 24 (21). Elytra with all the intervals approximately even *æquus*, sp. n.
- 25 (20). Elytra with the dorsal punctures entirely obliterated by the scaling; the scape much broader than the middle of the front tibiæ; prothorax with four shallow dorsal impressions. *scapularis*, sp. n.
- 26 (13). Elytra without any basal transverse impression, the basal margin vertically truncate, its upper edge not projecting *bolivianus*, sp. n.

Subfamily *CRYPTORRHYNCHINÆ*.

STYRACOPUS, gen. nov.

Head not concealed from above, the eyes distant. *Rostrum* short and stout, its apex about as broad as the eye. *Antennæ* with the scape reaching the eye, the funicle 7-jointed. *Scutellum* minute. *Elytra* short, with prominent shoulders; the tenth stria abbreviated. *Sternum* with the rostral furrow reaching the middle coxæ; the mesosternum forming a cup-like cavity and not extending backwards beyond the middle of the coxæ; the metasternum between the coxæ as long as

the portion of the first ventral segment behind the coxa; the metepisternum broad and conspicuous. *Venter* with the intercoxal process broad and angulate; plate 1 with its hind margin sinuate; plate 2 as long as 3+4. *Legs* short; the femora neither dentate nor sulcate beneath, the hind pair not reaching further than the apex of the fourth ventral plate; the tibiæ curved at the base and somewhat compressed, uncinatè, and with an additional shorter perpendicular spur a little above the uncus on the inner edge; the tarsal claws simple.

Type. *Styracopus phaseoli*, sp. n.

The species upon which this genus is founded has quite the appearance of a small *Tyrannion*, Chmp., but differs from that genus in its stout rostrum, minute scutellum, and unarmed femora, and also in having an additional inner spur at the apex of the tibiæ.

Styracopus phaseoli, sp. n.

Colour piceous, with dense fawn-coloured scaling and ill-defined whitish markings; the prothorax with three very indistinct paler stripes; the elytra with the following whitish markings:—the outer margin as far as the eighth stria; an oblique band from the shoulder ending on stria 2 just before the middle; a spot on interval 7 a little before the middle; a short line at the base of interval 4; a patch at the top of the declivity between striæ 1 and 4, bordered in front by a dark brown band; and a short stripe at the apex of interval 3.

Head with very coarse confluent punctation, clothed with large circular scales and raised, curved, scale-like setæ; the forehead nearly as broad as the apex of the rostrum, and separated from the rostrum by a shallow transverse impression; the eyes with a narrow raised rim round the upper margin. *Rostrum* thick, gently curved, parallel-sided from the base to beyond the middle, the apical portion slightly widened; the upper surface with large reticulate punctures as far as the insertion of the antennæ, with an inconspicuous wavy central carina and a less distinct one on each side of it, the apical area smooth and with scattered small punctures. *Antennæ* testaceous brown; the scape straight and gradually clavate; the funicle with joint 1 as long as but thicker than 2, the remainder short, bead-like, and subequal in length; the club broadly ovate, as long as the four preceding joints. *Prothorax* much broader than long, the sides very strongly rounded, broadest at the middle, the apex much narrower than the base, the latter bisinuate and with a broad median

lobe, the subapical constriction well marked, the apical margin strongly rounded dorsally, the postocular lobes well developed; the upper surface markedly convex in both directions, set with large shallow foveæ, which are more or less contiguous; usually there is a small smooth space in the middle and a small low rounded prominence on each side just in front of it, and also a distinct short central carina on the basal lobe; the scales are circular, much larger than those on the elytra, not overlapping, and each one filling a separate fovea; where the three paler stripes lie there are scales only, in the intervening spaces there are fewer scales, the remaining foveæ each containing a broad, raised, curved, scale-like seta. *Elytra* short, the width being nearly three-fourths of the length, the basal margin sinuate only in the middle for the reception of the thoracic lobe, the sides subparallel to beyond the middle, the apices jointly rounded; the striæ with coarse punctures, which are almost hidden by the scaling, the intervals shiny, with minute shallow punctures beneath the scales, the declivity strongly impressed on each side before the apex; the scaling dense and overlapping, interval 1 bare at the base only; the setæ sparse, broadly lanceolate, straight, and obliquely raised, almost lacking on intervals 4, 6, and 8.

Length $5-5\frac{1}{2}$, breadth $2\frac{1}{2}-2\frac{3}{4}$ mm.

LESSER ANTILLES: Dominica (*H. A. Ballou*, type); bred from larvæ boring in the stems of beans, St. Vincent (*W. N. Sands*).

LIII.—*Some Species of Crisia*,
By ARTHUR WM. WATERS, F.L.S., F.G.S.

[Plate XVI.]

AT the time when I first determined *Crisia* from Naples the descriptions of our leading authorities were most unsatisfactory, as often several quite different species were united under one name; so that, while the separation and description of the species dealt with were correct, so far as they went, it was absolutely impossible without a large personal knowledge from various places, that all the determinations should be reliable—and all workers were finding the same difficulties. Although the Busk, Hincks, and other collections are now available for reference in South Kensington, our path is not yet smooth, and much work is still needed on the genus; but

material advance has been made, for, besides other characters, we now recognize that the ovicells are most useful by their shape and that of the oöciostome; another useful character is the longitudinal distance from zoöcium to zoöcium, as is also the size of the aperture of the zoöcium. The distances of the zoöcia from one another must not be measured in the basal portion of the zoarium; nor must we take the one or two lowest zoöcia of an internode; but, taking older zoöcia, the variation is usually but slight, so that the typical size is easily obtained by measuring a few cases, and abnormalities through arrested growth are readily distinguished.

Harmer has shown that the position of the basis rami give useful classificatory assistance. Some are, as Harmer says*, "wedged in" between two zoöcia, which occurs always in what I should call the *denticulata* group and in a few others, as *C. conferta*, B., *C. sigmoidea*, sp. n., &c., but it is not common; others have the basis rami long, reaching to the next zoöcium, as in some *C. ramosa*, Harm., and a large number of other species as seen in *C. eburneo-denticulata* (see Pl. XVI. fig. 4). A third group has a very short basis rami, ending before it reaches the lower zoöcium—as, for example, in *C. eburnea* (fig. 6), in some *C. ramosa* in which both long and "graft" basis rami occur, and in a large number of the smaller forms of *Crisia*. This last group I have distinguished in my notes as the "graft" form, as it reminded me of a grafted tree or shrub. In connection with the basis rami there is still another character, perhaps of greater importance than the shape—that is, the width of the base of the internode, which may entirely differ from the diameter of the zoöcia. The bases rami that are wedged in are the widest, and I have elsewhere alluded to the fact that in most cases the size of the base of the lateral and main internodes is the same; but in a few with "graft" basis rami, as *C. edwardsiana*, the base of the branches is slightly less than that of the main stem. In the *denticulata* group the basis rami is wider than in the other groups, being wider than a zoöcium, as can be best seen in the new branch, where from the wide joint the first zoöcium gradually becomes narrower. This is shown in my figure of what I considered was *C. elongata*† and also in the figure now given of *C. eburneo-denticulata*, B. (fig. 4), the base of which is 0.12 mm.; the base of *C. ser-*

* "On the British Species of *Crisia*," *Micr. Journ.* vol. xxxii. n. s., p. 130 (1891).

† *Proc. Zool. Soc.* 1914, pl. i. fig. 3.

C. elongata was but slightly described by Milne-Edwards, and a figure without a scale was given which really might pass for various species.

rata, sp. n., is 0.16 mm., of *C. denticulata* 0.11–0.12 mm., of *C. acropora* 0.12 mm., of *C. elongata*, Waters, 0.14 mm., of *C. elongata*, Harmer, 0.12 mm., of *C. conferta*, B., 0.13 mm., of *C. sinclairiensis*, B., 0.08 mm., of *C. sigmoidea*, sp. n., 0.1 mm., of *C. denticulata*, var. *verdensis*, nov., 0.08 mm.

In the second group the basis rami is long, reaching to the next zoecium, as may be seen in *C. ramosa*, Harm., base 0.08 mm. wide, *C. tubulosa* (Cape Verde), 0.1 mm., *C. sertularoides*, Aud., 0.06 mm., *C. circincta*, Waters, 0.06 mm., *C. laxa*, Busk, 0.07 mm.

In the third group with the "graft" basis rami are *C. fistulosa*, Hell., base 0.11 mm. wide, *C. eburnea*, Lamx., 0.05 mm., *C. edwardsiana*, d'Orb., main internode 0.05 mm. wide at base, branch internodes 0.04 mm. wide, *C. geniculata*, M.-Ed., 0.03 mm., *C. cornuta*, L., 0.02–0.03 mm. For examining the basis rami properly it is necessary to have balsam preparations, and other points are seen more satisfactorily with such slides.

There is still another character which may give us a little assistance, and that is the frequency of the surface-pores. The number in a square 0.1 mm. may be counted, but as the surface is not flat, and as the zoecial boundary-lines occur close together, anything like exactness is out of the question, and we must be satisfied with general expressions, and might be guided by taking about ten pores to the square (0.1 mm.) as few, ten to twenty moderate, over twenty numerous. *C. eburnea*, *C. eburneo-denticulata*, *C. ramosa* are few; *C. tubulosa*, *C. sertularoides*, *C. laxa* are moderate; *C. denticulata*, *C. sigmoidea* are numerous. In the ovicells the pores are about twice as numerous as in the zoecia.

Busk and others have thought they had found *elongata*, then I¹ got a form from Wasin (Brit. E. Africa) which seemed to me to be certainly *C. elongata*, and unfortunately, instead of giving it a new name, I placed it under *elongata*, hoping that the difficulties would be laid to rest. Since then Harmer² has found a species in the 'Siboga' material which he considers is the *C. elongata*, and with this he places the forms described by Busk and me as synonyms. With this I cannot agree. Naturally, if I am right that the species first redescribed as *elongata* is not the same as Harmer's, then it would seem impossible for the name to be retained for the 'Siboga' specimens, even if these should only represent one species. Certainly we should all have been wiser to have dropped the name altogether.

¹ "Mar. Fauna of Brit. East Africa and Zanzibar, Bryozoa," Proc. Zool. Soc. London, 1914, p. 838, pl. i. figs. 3, 4, pl. iv. fig. 6.

² "Polyzoa of the 'Siboga' Expedition, Ent., Cten., & Cyclost.," p. 96, pl. viii. figs. 1–8 (1915).

In some species, as, for example, *C. denticulata*, the joints, except in the youngest branches, are always black. In no species are the joints black when quite young, and in the commencement of a branch there is no discontinuity, the breaking through of the walls at a joint occurring later on, just as in *Cellaria* and other jointed genera. There are other species in which the majority of joints are light, only the oldest ones being black or dark, while in a considerable number of species there are only light joints, as in *C. eburneo-denticulata* and most of the species with few zoëcia in an internode. In *C. ramosa*, Harm., from the Mediterranean, the joints are usually light, as is the case in specimens from Naples and the Gulf of Taranto; but in some from Capri and Genoa the lower joints are dark or black, and in a specimen from Plymouth the lower joints are somewhat darkened. The colour of the joint is undoubtedly useful generally, but must be taken in conjunction with other characters; and this may be said of every single character, and with more material their value has to be tested. We must not deal with them on too hard-and-fast lines, as if there could be no variation, but by taking all available we shall see in which group various characters occur, and thus relationships will be found. With regard to size and measurements, these are of the greatest use in examining a fauna of any locality; but we must be prepared to find some changes when spread to distant localities.

Crisia serrata, sp. n. (Pl. XVI. figs. 1, 2, 7.)

The zoarium is composed of long, stout, straight internodes, the branchless ones having an uneven number of zoëcia (21–23), while none of the internodes have fewer than 20 zoëcia, and one has 25. There is only one branch to each internode, occurring usually after the seventh to eighth zoëcium on that side. The part of the internode above the branch is narrower than that below—a character also figured by Busk in *C. acropora*, Busk. The basis rami is “wedged in”—that is, the basis rami is short and reaches to the zoëcium below. The base of the branch is about 0.16 mm. and the joints are black.

The zoëcial terminations are very short, directed frontally and some distance from the edge of the zoarium, the aperture being the smallest of any known species (0.04 mm.), although the zoarium is the stoutest of any species of *Crisia*. The zoëcia are not very far apart longitudinally (only 0.21–0.24 mm.). There is a large projection behind the end of

each zoëcium, being much more pronounced than in *C. denticulata*, and this gives it a serrate appearance. The denticle of *C. acropora*, Busk, is similar in position—namely, more or less behind the zoëcium,—though much smaller, and no doubt these two species are closely allied; also the species which I considered was the *C. elongata*, Milne-Edwards, shows great resemblance in having long straight internodes with only one branch to each internode, and that from the distal half of the internode; but I am unable to consider that the *elongata** I figured is the same as what Harmer calls *elongata*.

The specimen from Port Elizabeth, S. Africa, was sent to me by Miss Jelly, and has been overlooked.

I have previously † remarked on there being many massive and solid Bryozoa from S. Africa, and now we get this large *Crisia* with branches about 0.42 mm. wide.

Loc. Port Elizabeth, S. Africa.

Crisia oranensis, sp. n. (Pl. XVI. fig. 3.)

From a quantity of dredged material from Oran (Algiers) there is only the fragment figured belonging to this species. It has an ovicell quite similar to that of *C. eburnea*, L., but the internode is apparently longer than in *C. eburnea*, then the basis rami reaches to the next zoëcium, whereas in *eburnea* it is very short and of the "graft" group. The zoarium is also wider, as is the base of the branch, and the surface-pores are more numerous.

The zoëcial tubes hardly project at all, which seems to be a character of *C. eburneo-denticulata*, Busk, and the ovicells of both are fairly similar, though the shape of the oöciostomes is not identical‡. A similarity of form will be seen between figs. 4 and 3, though it should be noticed that the scale of fig. 4 is only half that of fig. 3. The distance from zoëcium to zoëcium is only about 0.31 mm., whereas in the *C. eburneo-denticulata*, now figured, they are of the unusual distance of 0.5 mm. Making some comparisons, when only a tracing was available on which there was no scale, led to my coming temporarily to a false conclusion. The joints of this species, of *C. eburnea*, and of *C. eburneo-denticulata* are all light, and no doubt they belong to the same group.

From the Oran débris I picked out several other separate

* See footnote †, p. 470.

† "Résult. du Voyage du S.Y. 'Belgica,' Bryozoa," Expéd. Antaret. Belge, p. 79 (1904).

‡ See footnote, p. . 475.

internodes, and was able to determine *C. eburnea*, L., *C. fistulosa*, Hell., and *C. sigmoidea*, Waters.

Dr. Harmer kindly allowed me to examine some 'Siboga' slides of what he considers *C. elongata*, and among them was 37 U, which he has queried in his report. This, however, has very long straight internodes, with the branches narrower than in other specimens of his *C. elongata*; the branches are given off pretty high in the internode after the third or fourth zoecium of that side; the base of the internode is about 0.07-0.08 mm., with the basis rami long, reaching to the next zoecium; the zoecia project at the end but very slightly, and the joints are light. The straight internodes, the basis rami long instead of being wedged in, and the light joints indicate that it belongs to the *eburneo-denticulata* group, and not to the *denticulata* group, of which *C. elongata*, Harmer, is a member. It is much like the present *C. oranensis*, though rather narrower.

On the other queried slide, 37 R, there is, among others, a specimen similar to the present in having a long basis rami, long narrow internodes, but the joints are black, and otherwise in the shape of the branches, form of the basis rami, the distance between the zoecia, and the ovicell there is a resemblance to *C. ramosa*, Harm. Harmer suggests in his report that this may be the *C. denticulata*, var. *gracilis*, Busk, and this, I believe, is the case, though with the long basis rami not wedged in and the small pyriform ovicell it would hardly seem to belong to the *denticulata* group, and should stand as *C. gracilis*, Busk.

Loc. Oran (Algiers).

Crisia eburneo-denticulata, Busk.

(Pl. XVI. figs. 4 & 5.)

Crisia eburnea, var., Smitt, Kr. Fört. öf Skand. Hafs Bry. 1865, pl. xvi. figs. 9, 10, 11.

Crisia eburneo-denticulata, Busk, Cat. Mar. Poly. in the Brit. Mus., Cyclost. p. 5, pl. vi. (1875); Vigeliu, Cat. of Polyzoa d. Cruise of the 'Willem Barents,' Nederl. Arch. f. Zool. p. 4 (1882); Ortmann, Die Japanische Bry., Arch. für Naturgesch. vol. i. p. 58, pl. iv. fig. 18 (1890); Calvet, Bry. Mar. de Cete, p. 72 (1902); Waters, Bry. from Franz Josef Land, Cycl., Journ. Linn. Soc., Zool. vol. xxix. p. 165 (1904).

Zoarium with straight internodes, no intermediate space; branches one, two, three, or four; few surface-pores (about five to the square 0.1 mm.); basis rami fairly long; base of internode 0.12 mm. The ends of the zoecia project but very slightly in all the specimens examined, whereas Smitt, in

fig. 9, shows them free for a considerable distance; however, this is not the case in Busk's figure. The ovicells are long, pyriform, with a tubular oöciostome, usually compressed, so that it is much wider laterally (0.12 mm.). Specimens from Kola Bay, given to me by Dr. Kluge, have very long internodes with as many as thirty zoöcia; in these specimens there may be branches after the second zoöcium, but more frequently not until the sixth to ninth on that side, and there may be also one, two, or three branches higher up.

Specimens from Granville Bay, West Greenland, also given to me by Dr. Kluge, who had named both *C. eburneo-denticulata*, have not more than twenty-five zoöcia to an internode, but some of these have a growing end, and so are not completed. In this the distance from zoöcium to zoöcium is about 0.5 mm., and in the Kola specimen is about 0.4 mm.; the aperture of the zoöcium is about 0.06–0.07 mm., the base of the internode is about 0.12 mm., the basis rami is long and the joints are light.

A specimen which I named *eburneo-denticulata*, from Franz Josef Land, has shorter internodes, with the branches arising from after the first zoöcium on that side; the basis rami is short, not reaching to the zoarium below; there are not above thirteen zoöcia to an internode, but the general structure is similar to other *eburneo-denticulata*, though approaching *C. eburnea*. There are, however, no ovicells. The number of pores in all is similar.

In specimens in the Natural History Museum from Smeerenberg, Spitzbergen; Rekiavie, Greenland; and Castrens Oöe, there are not more than eighteen zoöcia to an internode, so that possibly the present form should be looked upon as a variety. There does not seem to be sufficient reason for separating the present form generically on account of the contracted oöciostome, for in *C. eburnea*, in the Natural History Museum, I have seen a round and contracted oöciostome on the same colony.

The long forms in some respects resemble *C. pugeti**, Rob., but they are not identical.

The double name *eburneo-denticulata* is very unfortunate, as the species seems to belong to the *eburnea* group, and not to the *denticulata* group. I have from Naples some long

* "Cyclost. Bry. of the North-west Coast of America," Univ. of California Pub. Zool. vol. vi. p. 244, pl. xx. figs. 20, 21 (1910). Dr. Alice Robertson's figures always give me the impression of being very well drawn and instructive, but they are reproduced by such an unsatisfactory method that the sharp outlines and details are lost. In my copy of this paper the details of the oöciostomes can in no case be made out, though evidently drawn sharply.

specimens of *Crisia*, no doubt *eburneo-denticulata*, with fairly long straight internodes with seventeen to thirty-one zoecia, the joints yellow, the zoecial aperture 0.07 mm., the base of the internode or branch 0.11 mm., the zoecial aperture projects but very little. There are no complete ovicells, but two are commencing at the end of branches. In one of these internodes one branch is after the second zoecium, another after the sixth on the other side, and soon after this the ovicell commences; in the other case the ovicell is about the same distance up the internode, in which there is only one branch, and that after the second zoecium, with an ovicell on the other side by the sixth to seventh zoecium. The zoecia are about 0.45 mm. apart, and the number of surface-pores is about the same as in the northern forms of *C. eburneo-denticulata*.

Ortmann's description would seem to refer to *eburneo-denticulata*; however, the figure shows wide branches, but the scale is too small to attach much importance to this difference.

Loc. Spitzbergen, 70-96 fath. (*Busk*); Barents Sea, 150 fath. (*V.*); Cetta (*Calvet*); Japan? (*Ort.*); Franz Josef Land (?), 130 fath.; Granville Bay, West Greenland, 30-40 fath.; Kola Bay, 40 fath.; Smeerenberg; Rekiavie; Castrensis Oöe, 30-40 fath.; Naples.

Crisia sigmoidea, sp. n. (Pl. XVI. figs. 9, 10.)

Crisia denticulata, Waters, Bry. of the Bay of Naples, Ann. & Mag. Nat. Hist. ser. 5, vol. iii. p. 269, pl. xxiii. fig. 2 (1879).

This species I have from Naples, Rapallo, &c. The branches are very wide, with an "intermediate space," and in general appearance it closely resembles *C. conferta*, *Busk*, but no oöcial tube has been seen on any of the ovicells. Harmer alludes to sigmoid curves in his *C. elongata*, which sometimes occur to a certain extent in *C. denticulata*, *Lamx.*, though in this last not pronounced as in the present species. The ovicell, of which but a limited number have been seen, is wide and short, and there are usually two branches on the same side near to the ovicell. The oöciopore is a slit, as in *C. denticulata* and *C. elongata*, *Harmer*.

The basis rami is "wedged in," corresponding in this respect to *C. denticulata*; but the joints are light, whereas in *C. denticulata* they are black. The base of the branch is wide (0.1 mm.). The branches start after the first, second, or third zoecium on that side, frequently two originating from the same side, just as in *C. elongata*, *Harmer*, while in

C. denticulata they are usually alternate on the following branch. There are about twenty to twenty-six zoecia in an internode, with zoecia about 0·26 mm. apart.

In the specimen figured there are, besides the ordinary narrow radicles (0·06 mm.), some wide tubes (0·09–0·12 mm.) given off, either from the end of an internode, or in place of a lateral branch from the basis rami; these may grasp any adjacent object spread out and give rise to a new subcolony (fig. 10, *w.r.*). In the Journ. Linn. Soc., Zool. vol. xxxi. pl. xxiv. fig. 3, I have figured several radicles from the end of one branch, but these continue the same size as ordinary radicles, not wide as in the present case. Also in *C. sinclairiensis*, Busk, one of the terminal members of an internode is continued as a long conical spine, becoming narrow at the end, and in one specimen in my possession from Port Elizabeth, S. Africa, it is jointed, showing a similarity to a radicle.

I have several examples of *Crisia* throwing out radicles, some even a considerable distance from the base, from which fresh subcolonies can grow, but I know no other case in which there are wide radicles, of a different type to the ordinary ones, replacing a branch.

With regard to the wide internodes, there is a resemblance to *C. conferta*, Busk, which has a funnel-shaped oeciostome and wider basis rami, to *C. elongata*, Harmer, which has black joints, to *C. elongata*, Waters, *C. serrata*, Waters, *C. denticulata*, Lamx., all with black joints.

C. sertularoides, Aud., has light joints and the oeciostome has a funnel.

Loc. Naples; Rapallo; Villefranche-sur-Mer; Oran (Algiers); Cape Verde Island, collected by Crossland.

EXPLANATION OF PLATE XVI.

Fig. 1. *Crisia serrata*, sp. n., $\times 50$. From Port Elizabeth, S. Africa.

Fig. 2. Ditto, $\times 25$. Dorsal surface.

Fig. 3. *Crisia oranensis*, sp. n., $\times 25$. From Oran (Algiers).

Fig. 4. *Crisia eburneo-denticulata*, Busk, $\times 12$. From Granville Bay, West Greenland.

Fig. 5. Ditto, $\times 2$.

Fig. 6. *Crisia eburnea*, L., $\times 25$. Showing the "graft" form of the basis rami.

Fig. 7. *Crisia serrata*, sp. n., $\times 12$.

Fig. 8. Ditto, $\times 2$.

Fig. 9. *Crisia sigmoidea*, sp. n., $\times 25$. Ovicell. From Naples.

Fig. 10. Ditto, $\times 12$. From Naples. Dorsal surface, showing wide radicles starting from the basis rami and replacing the branches; see (*w.r.*).

LIV.—*Description of a new Fish of the Genus Barbus from the Niger.* By G. A. BOULENGER, F.R.S.

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Barbus francisci.

Depth of body $3\frac{1}{3}$ times in total length, length of head 4 times. Snout rounded, a little shorter than the eye, which is 3 times in length of head and equals interorbital width; mouth subinferior, small; lips feebly developed; two barbels on each side, anterior $\frac{2}{3}$ diameter of eye, posterior $\frac{3}{4}$. Dorsal III 8, equally distant from anterior border of eye and from caudal, border scarcely concave; last simple ray not enlarged, not serrated, as long as head. Anal III 5, not reaching caudal. Pectoral $\frac{3}{4}$ length of head, not reaching ventral; base of latter below anterior rays of dorsal. Caudal peduncle slightly longer than deep. Scales radiately striated, $23\frac{3\frac{1}{2}}{3\frac{2}}\frac{1}{2}$, $2\frac{1}{2}$ between lateral line and ventral, 12 round caudal peduncle. Silvery, back yellowish olive; dorsal and caudal yellow, blackish at the tips.

Total length 63 mm.

A single specimen from Mutum Bui, 90 miles east of Ibi, S. Nigeria, in a tributary of the Benue River; presented to the British Museum by Mr. Claude Francis.

The Hausa name of this fish is "Dendskuri."

B. perince, Rüpp., from the Nile, is the nearest ally of this new species, which is readily distinguished by the narrower interorbital region and fewer scales in the lateral line.

The collection made by Mr. Francis in the Benue River contains an example, from Ibi, of *Pelmatochromis intermedius*, Blgr., recently described from Sierra Leone.

LV.—*Two new Muridæ from South America.*

By OLDFIELD THOMAS.

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Oxymycterus doris, sp. n.

A dark brown species, with no red either on back or sides. Size fairly large, about as in *O. inca*. Fur rather thin and straight, not shaggy, hairs of back about 11 mm. in

length. General colour above brown (between Prout's brown and mummy-brown), finely ticked with buffy, the ticking markedly finer than the coarse grizzling or lining of other species. Sides a little paler than back, but essentially similar, without any tinge of rufous. Under surface soiled grey, the ends of the hairs washed with buffy; chin and throat paler, a patch of white (to the roots of the hairs) present on the interramia in both specimens. Ears darker than head, the proectote and metentote nearly black. Hands and feet dark brown. Tail uniformly blackish brown.

Skull with long heavy muzzle, the nasals slightly trumpet-shaped terminally. Bullæ larger than in *O. juliace*.

Dimensions of the type (measured in flesh):—

Head and body 150 mm.; tail 126; hind foot 31; ear 21.

Skull: greatest length 37·5; condylo-incisive length 32·5; zygomatic breadth 16; nasals 14·8 × 5; interorbital breadth 6·6; palatilar length 13·7; palatal foramina 7·6; upper molar series 5·5.

Hab. Charuplaya, Upper Mamoré, 65° 5' W., 16° S., Bolivia. Alt. 1350 m.

Type. Adult male. B.M. no. 2. 1. 1. 95. Original number 1441. Collected 21st May, 1901, by Perry O. Simons. Presented by Oldfield Thomas. Two specimens.

This brown species is one which I formerly thought to be *O. juliace*, Allen, but as its most marked character is the complete absence of red in its coloration, and the reddish sides and chestnut back of *O. juliace* are emphasized in Allen's description, I am now driven to conclude that it is distinct.

Thomasomys laniger emeritus, subsp. n.

Closely similar to true *laniger*, but larger.

General characters and colour quite as in *laniger*, though the light postauricular patch is scarcely perceptible.

Skull longer than that of *laniger*, although the single specimen of *emeritus* is younger than the majority of our series of *laniger*. Palatal foramina not so nearly reaching the level of the front of *m*¹. Mesopterygoid fossa more broadened in front, narrowed posteriorly; in *laniger* it is always more nearly, sometimes quite, parallel-sided.

Dimensions of the type (measured on skin):—

Tail 132 mm.; hind foot 23.

Skull: greatest length 29·7; condylo-incisive length 26; zygomatic breadth 15·3; nasals 10·6; interorbital breadth

4·7; palatilar length 11·6; palatal foramina 5·8; anterior breadth of mesopterygoid fossa 2·7; upper molar series 4·7.

Hab. Merida, Venezuela. Type from the Montes de Escagner, alt. 2500 m.

Type. Young adult male. B.M. no. 5. 1. 1. 4. Collected 30th April, 1904, by S. Briceño. Presented by Oldfield Thomas.

LVI.—*New Species of Butterflies and Moths from Australia, Africa, and the Indo-Malayan Region.* By Colonel C. SWINHOE, M.A., F.L.S., &c.

RHOPALOCERA.

Family Euplocidæ.

Vadebra kala, nov.

♂ ♀. Upperside very dark pure black, no markings; hind wing with all the costa and outer border broadly paler, tinged with chocolate-colour. Underside paler; fore wing with the hinder margin broadly whitish; a small white spot at the end of the cell, two beyond it, another in a line with these two near the costa, and a series of from two to five similar submarginal spots from the apex hindwards: hind wing with more than the lower half of the outer margin broadly paler, of the same colour as it is on the upperside; a large white spot at the end of the cell, a whorl of seven spots curved round it, one in each interspace; four submarginal small spots—one in each of the four upper interspaces—and three or four minute dots on the margin below the apex; thorax below with some white spots, and two or three at the end of the abdomen, the anal one the largest. The female only differs from the male in having all the spots on the underside larger.

Expanse of wings, ♂ ♀, $3\frac{2}{10}$ inches.

Hab. New Britain.

Isamia noblei, nov.

♂. Upperside: fore wings blue-black, without any markings: hind wings blackish brown, pale on the upper half; a broad, white, club-shaped streak on the upper margin of the cell from near the base to beyond the end of the cell; a double row of more or less indistinct small white spots

near the outer margin. Underside exactly as in *I. splendens*, Butler = *irawada*, Moore.

Expanse of wings, ♂, $4\frac{4}{10}$ inches.

Hab. Rangoon.

I received this in 1887 from Mr. Noble, who was then Curator of the Rangoon Museum; he had other specimens. Moore figured it in *Lep. Indica*, pl. xlviii. fig. 1 e, as a var. of *irawada*, which is very doubtful; it resembles no other form of this genus, and deserves a name.

Family Pieridæ.

Ixias splendida, nov.

♂. Pale sulphur-yellow: fore wing with a very large orange subapical patch, limited inwardly by a narrow straight black band from the costal third, across the cell a little beyond its middle to the outer margin a little above the hinder angle, where it joins the apical black band, which encircles the orange patch and is continued to the hinder angle; the inner margin of the apical band runs in a little into the orange patch on the veins, forming curves to the patch in each interspace; there is a small tooth from the straight black band, the point of which touches the lower end of the cell, and there is a thick black lunular mark in the middle of the discoidal veins; there is also a blackish narrow costal band and a basal patch of black irroration: hind wing also with some black basal irroration and large suffused black spots on the outer margin at the vein-ends. Underside pale dull yellow: fore wings with a black small spot on the middle of the discoidal veins, four faint grey subapical rings, and on the hind wing a black spot on the discoidal, and five large whitish spots broadly ringed with dull chocolate-brown—one on the costa beyond the middle, and a row of four in the middle of the disc, the two centre ones the largest; the apical portion of the fore wing and the whole of the hind wing sparsely covered with brownish irroration.

Expanse of wings, ♂, $2\frac{2}{10}$ – $2\frac{4}{10}$ inches.

Hab. Polisha and Jainau, Formosa.

A very handsome *Ixias*.

Delias aruna rana, nov.

♂. Upperside chrome-yellow, very similar to *aruna*, Boisduval, from Dutch New Guinea. Underside: fore wing black, as in *aruna*, with more than the basal half scarlet, much more than in *aruna*, its outer edge not evenly rounded

as in that species, but extended in its middle to an obtuse angle.

♀. More or less similar to the female of that species, but on the upperside of the fore wing the white patch at the end of the cell is much smaller, and the white space on the hind wing beneath as in the scarlet space of the male.

Antennæ of both sexes pure white above, marked with black beneath.

Expanse of wings, ♂ $3\frac{1}{10}$ – $3\frac{2}{10}$, ♀ $3\frac{2}{10}$ – $3\frac{5}{10}$ inches.

Hab. Amboina.

A fine series of both sexes of this very handsome subspecies.

Family Nymphalidæ.

Apatura hypna, nov.

♀. Upperside blackish brown: fore wing with a dull orange broad patch from vein 3 to the hinder margin; an oblique band of five subapical, white, rather small spots in interspaces 3, 4, 5, and 6, the lowest spot the largest, decreasing in size upwards, the upper one very small and round; a submarginal series of small round white spots, one in each interspace, the lowest nearly obsolete, the second from the top elongate; a double series of small dull ochreous spots close to the outer margin, four in each interspace, the outer series more or less lunular; cilia black, outwardly edged with white: hind wing with a broad dull orange discal band, which becomes obscure at both ends, not reaching either costa or abdominal margin; a series of obscure dull ochreous spots near the margin, followed by a series of lunules on the margin; cilia as in the fore wing. Underside chestnut-brown, markings as on the upperside, but all very large and prominent; fore wing with four white costal spots between the oblique subapical band and the base of the wing, and on the middle of the costa of the hind wing a large white spot inwardly edged with black.

Expanse of wings, ♀, $3\frac{4}{10}$ inches.

Hab. Fiji.

Apatura tracta, nov.

♀. Upperside similar to the above-mentioned form, but on the fore wing the oblique subapical band of white spots is wanting; the orange patches on both wings brighter and larger, the marginal spots hardly visible. Underside much duller in colour; the large white spot on the middle of the costa of hind wing not present.

Expanse of wings, ♀, $3\frac{2}{10}$ inches.

Hab. Fiji.

Neptis guamensis, nov.

♀. Resembles *N. papaja*, Moore, from Sumatra, but on the upperside the postdiscal band of white spots on the hind wing are much larger, and on the underside the discal band of this wing is highly recurved.

Expanse of wings, ♀, $2\frac{6}{10}$ inches.

Hab. Guam, Marianne Islands (Ladrones), in the Pacific.

Family Hesperidæ.

Osmodes omar, nov.

♂. Upperside bright orange: fore wing, costal line black, outer marginal band broadly black, uniform, as broad as in *O. distincta*, Holland*; a black band from the costa one-fourth from the apex, with a short thick branch outward, then curving inwards into the interno-median interspace, where it is bottle-shaped, narrowly joining the upper part, and hindwards connected with the base of the wing by a narrow black line along the internal vein; some blackish irrorations at the base and along the basal half of the costa: hind wing with a broad costal black band which thickens beyond its middle in a round curve almost to the sex-mark of raised scales, outer margin narrowly black; cilia orange, in the fore wings with square black spots at the vein-ends, these spots on the hind wing small and not extending across the cilia. Underside: fore wing dull orange, bands as above, but they become nearly obsolete upwards: hind wings paler, greyish orange; three white spots ringed with black, as in *O. thora*, Plötz†, the upperside markings faintly indicated. Head and body above orange, covered with brown hairs below; the palpi, body, and legs are greyish white.

♀. Differs from the male in having a much broader outer marginal black band which is connected with the outer branch of the discal band, this band not continued hindwards, and both wings by the larger space of black basal irrorations which cover nearly the basal third of each wing.

Expanse of wings, ♂ $1\frac{3}{10}$, ♀ $1\frac{4}{10}$ inch.

Hab. Entebbe, Uganda.

Padraona alix.

Apantus alix, Plötz, Stett. ent. Zeit. 1884, p. 165 (unpublished plate no. 768).

* Figured by Holland in P. Z. S. 1896, pl. iv.

† Figured by Holland in P. Z. S. 1896, pl. iv. figs. 3 ♂, 4 ♀.

Pamphila lascivia, Rosenstock, Ann. & Mag. Nat. Hist. (5) xvi. p. 378, pl. ii. fig. 1 (1885).

Pamphila neocles, Mabille, Compt. Rend. Soc. Ent. Belg. xxxv. p. 177 (1891).

In his "Revision of the Australian Hesperidæ" * Mr. Oswald B. Lower makes *alix* of Plötz a synonym to *Bibla papyria* of Boisduval †—from Plötz's description, I presume; Fruhstorfer, in his monograph of the Hesperidæ in 'Iris,' 1910 and 1911, omits it altogether. In 1908 I was fortunate enough to obtain the loan of Plötz's six volumes, containing his unpublished figures of the Hesperidæ, through the kindness of Director Robert Erhardt, of Munich—all hand-coloured excellent figures. I sent Mr. Lower copies of those relating to Australia, but, unfortunately, the copy of *alix* was omitted. I kept copies by Mr. Horace Knight of all the Indo-Malayan species, and amongst them I find a copy of *alix* from New Holland; it is identical with *lascivia*, which is in my museum from Waverley in New Zealand and from Cairns in Queensland, where it appears to be quite common, and which I have compared with Rosenstock's type in the British Museum. Lower says (p. 153) that he sent specimens of *lascivia* to Professor Mabille, who returned them as his *Padraona neocles*.

HETEROCERA.

Family Arctiidæ.

Arctia caja amboinensis, nov.

♂ ♀. Antennæ white; abdomen scarlet, with dorsal black bands on each segment, duller coloured beneath, with thin blackish segmental bands: fore wing red-brown, a subbasal narrow white band which runs narrowly outwards on the median nervure and inward broadly to the base, and contains a short brown streak; a small white spot on the costal third; a large white patch on the costa beyond the middle, narrowing hindwards, its inner side straight, its outer side deeply angled inwards; a discal X-shaped white band, its upper branch running to near the outer margin of the wing, then abruptly bent inwards and again outwards to the costa near the apex, its lower outer branch straight to the outer margin, then acutely angled inwards at the hinder angle of the wing, its inner branch slightly curved, reaches the hinder margin beyond the middle, and has an inward spur nearly meeting

* Trans. Roy. Soc. of S. Australia, xxxv. (1911).

† Voy. 'l'Astrolabe,' Lep. p. 166 (1832).

the outer streak on the median nervure from the subbasal band: hind wings scarlet, with six large black spots—the largest before the middle, a smaller one below it, a lunular spot at the end of the cell, and three large discal spots in a line well separated from each other; the whole pattern of the wings is more or less like the European *A. caja*, Linn., but with many subspecific differences.

Expanse of wings, ♂ ♀, $2\frac{6}{10}$ inches.

Hab. Amboina.

Received direct from my Amboina collector.

LITHOSIINÆ.

Agrisius plumbeonigra, nov.

♀. Palpi bright ochreous-yellow, third joint black: fore wing above dark plumbeous, with all the veins a little paler and quite distinct; seven black spots at the base all above the internal vein; a black spot at the end of the cell; a complete series of black spots from the middle of the costa to the middle of the hinder margin, curving deeply outside the cell-end, one in each interspace: hind wing darker black, no markings. Underside uniformly dark plumbeous, all the veins on both wings paler and distinct; a blackish mark at the end of each cell and a blackish shade in the disc. Antennæ, head, body, and legs dark, nearly black; abdomen with the anal segment ochreous.

Expanse of wings $1\frac{1}{2}$ inch.

Hab. Khasia Hills.

A smaller insect than *A. fuliginosus*, Moore, the spots on the fore wing somewhat similarly disposed, fewer at the base, an extra spot at the end of the cell, and altogether differently coloured.

Family Limacodidæ.

Scopelodes exigua, nov.

♂. Palpi, head, thorax, and fore wings above ochreous-fawn colour, palpi beneath black at their base: fore wing with the inner half darker than the outer, where the veins are more or less prominent; no markings; cilia dark chestnut-brown, the tips glistening whitish yellow: hind wing paler, also without markings, more than half the cilia glistening whitish yellow. Abdomen somewhat ochreous, faint indications of two blackish dorsal bands, anal tuft black above. Underside uniformly shining pale greyish ochreous, unmarked; body and legs darker; tarsi with black ends.

Expanse of wings, ♂, $1\frac{7}{10}$ inch.

Hab. Amboina.

Family *Catocalidæ*.*Grammodes frena*, nov.

♂. Grey-brown: fore wing with a narrow, erect, white, transverse band before the middle from subcostal vein to hinder margin, on which it is slightly dilated; a black patch on its inner side extending from the hinder margin to the cell, from which it narrows upwards almost to a point; a similar thin white band beyond the middle slightly dilated upwards, the space between the bands black; between this and the margin is an irregular black band from the hinder margin, dilated on its upper half, forming outward dentations at veins 3 and 4, the former the smaller, then curving outwards to the apex of the wing, the space on both sides of this band greyish rufous; a crenulate black marginal thread; grey cilia, with a pale basal line: hind wing fuscous brown, pale at the base; a large white spot before the middle, the upper half of the margin and cilia white; a black crenulate marginal thread; a white marginal spot near the anal angle; the lower half of the cilia fuscous brown, with a pale basal line. Underside: fore wing with the white transverse band broader, the basal space of the wings greyish ochreous, the outer space blackish: hind wing with the basal half greyish ochreous; a black discoidal lunule marked with white and a black spot a little beyond it, another small white patch below this, with black spots in each end of it; the outer half of the wing black, with a white crenulate submarginal line and white on the upper half of the margin and white subanal spot as on the upperside.

Expanse of wings, ♂, $1\frac{7}{16}$ inch.

Hab. Amboina.

Superficially resembling *G. cooma*, Swinhoe, from Queensland (Cat. Het. Mus. Oxon. ii. p. 158, 1900).

Family *Micronidæ*.*Urapteroides falka*, nov.

♂ ♀. Allied to *U. bifasciata**, Butler, from New Ireland: fore wing with the brown-spotted costal border, the marginal brown band, and the transverse pale ochreous-brown bands of both wings all much narrower; in the male the transverse bands are very narrow, very little better than thick lines;

* P. Z. S. 1879, p. 165.

the tails are shorter, and the black tail-spot round, not elongate as in that species.

Expanse of wings, ♂ $2\frac{5}{10}$ – $2\frac{6}{10}$, ♀ 3 – $3\frac{3}{10}$ inches.

Hab. Ekeikei, British New Guinea.

Urapteroides gutturalis, nov.

♂. Fore wing with the costal margin striated and marked with dark chocolate-brown, the markings all well separated, showing the pure white ground-colour between them; the bands on both wings darker than in *bifasciata*, the transverse bands not so broad, but broader than in *falka*; the shape of the tail and spots similar; the abdomen, except at the base, and anal tuft suffused with black; the head white, in *bifasciata* and *falka* it is black; the anal angle of the hind wings suffused with ochreous brown.

Expanse of wings, ♂, $2\frac{7}{10}$ inches.

Hab. Amboina.

Family Urapteryxidæ.

Thinopteryx crocopterata assamensis, nov.

♂ ♀. Markings similar to *crocopterata*, Kollar, from the N.W. Himalayas, of which I have both sexes, but the colour is quite different, being dark orange in both sexes, whereas the colour of *crocopterata* is yellow in both sexes ("flavis croceo maculatis"): *assamensis* is a very common form in the Khasia Hills; I have received very many specimens.

Expanse of wings, ♂ ♀, $2\frac{1}{2}$ inches.

Hab. Assam, Sikkim.

Thinopteryx crocopterata padanga, nov.

♂. Coloured like *assamensis*; markings similar, but the postmedian band of the fore wing and the submarginal band of the hind wing is darker and much broader and not so close to the margin; the basal half of the fore wing is suffused with brown striæ; the medial patch on the hind wing is very much more enlarged and runs down to the abdominal margin, and the tail at vein 4 is entirely dark brown, this colour expanding until it reaches the submarginal band. Underside with the ground-colour pale as in *assamensis*, but the bands are much broader and the outer two-thirds of the wing up to the submarginal band is greyish brown.

Expanse of wings, ♂, $2\frac{1}{2}$ inches.

Hab. Padang, Sumatra.

I have in my collection a very fair series of the following, all clearly distinct from each other:—*crocopterata*, Kollar; *assamensis*, mihi; *padanga*, mihi (one example); *nebulosa*, Butler; *delectans*, Butler; *citrina*, Warren; *lorquini*, Oberth. (one example).

Family Pyralidæ.

DICHOCROSINÆ.

Endocrossis kenricki, nov.

♂ ♀. Very like a small *E. flavibasalis*, Moore, but the wings are shorter and broader and the entire fore legs are broadly banded with chocolate-brown, and the inner chocolate transverse line of the fore wings above is represented by three spots in the four males and three females before me; there is no difference in size or markings.

Expanse of wings $1\frac{2}{10}$ inch.

Hab. Ekeikei.

There is an example in the B.M. unnamed.

Dichocrocis pulalis, nov.

♂. Bright ochreous yellow: both wings covered with large black spots, fore wings with six in the basal area, one in the cell, three conjoined across the end, slightly outwardly curved; a short similar band straight down from the costa one-fourth from the apex, followed by a nearly straight band of eight spots right across the wing, and three near the outer margin below its middle: hind wing with a large spot in the cell, a band of six spots across the middle of the wing, with a gap in its centre, followed by a slightly curved band of ten spots, and three near the middle of the outer margin: wings beneath paler, spots as above. Palpi, head, body above and below, and the legs concolorous with the wings; abdomen above with prominent spots on the first four segments.

Expanse of wings $1\frac{2}{10}$ inch.

Hab. Maymyo, Burma.

SYLEPTINÆ.

Ligropia sumatralis, nov.

♂. Palpi chocolate-brown, white beneath at base: fore wing palish purple-brown, somewhat glossy; a white spot in the middle of the cell, with a blackish square spot on each side of it, joined together; a large white spot beyond it, well beyond the end of the cell, with similar blackish spots

touching each side of it: hind wings darker, with a distorted whitish middle band, its centre part large and running upwards in an angle, its lower portion narrowing to the middle of the abdominal margin. Head and body above concolorous with the wings. Wings beneath greyish white, shining, the outer areas darker: fore wings with a black spot in the middle of the cell, one at the end, and another beyond it, adjoining a whitish spot which reaches the costa: hind wing with a short blackish discal band from the costa, and another more outwards below it. Body and legs white, a brown spot on the knee, and another at the base of the tarsus.

Expanse of wings $1\frac{1}{2}$ inch.

Hab. Padang, Sumatra.

With a superficial resemblance to *L. poltisalis*, Walker.

Lygropia nictoalis, nov.

♀. Palpi chocolate-brown, the first and second joints white beneath. Wings of a uniform dark purplish brown of the same shade of colour as *L. flavispila*, Swinhoe, described in this Journal (ser. 6, vol. xiv. p. 204, 1894) from the Khasia Hills, which it somewhat resembles: fore wings with a white spot at the end of the cell, a white discal band from the costa to vein 4, a minute white dot below it, and a spot near the hinder margin a little beyond its middle: hind wings with a white transverse band a little before the middle, from the costa, narrowing hindwards to the abdominal margin and bent slightly inwards at vein 2. -Underside pale purplish shining grey, markings as on the upperside; a fine whitish marginal thread on both wings. Head and body above concolorous with the wings; abdomen with fine white segmental bands; the face, body beneath, and legs are pure white.

Expanse of wings, ♀, 1 inch.

Hab. Padang, Sumatra.

PINACINÆ.

Euglyphis procopia graphica, nov.

♂ ♀. In Ann. & Mag. Nat. Hist. (7) xvii. p. 290 (1906), I named the Indian form as *falsalis*, on account of its distinctive differences from specimens I have from Fergusson Island, which I wrongly supposed to be the same as Cramer's species from Amboina. Now that I have received the true *procopia* from Amboina, I find that they differ materially

from those from Fergusson Island, which seem to be identical with a long series I have from different parts of British New Guinea. The yellow basal space, though more extensive than it is in the Indian form *falsalis*, is not nearly as extensive as it is in typical *procopia*; its outer edge on the hind wing is angled, whereas in *procopia* it is rounded, and the yellow streak on vein 2 of the fore wing in the purplish outer half is broader and prominent. When the genitalia of these forms come to be examined, I feel sure it will prove their distinctive differences, as it has done in so many similar cases in the Rhopalocera. *Procopia* is also the largest form of the three, the expanse of its wings measuring from $1\frac{9}{10}$ –2 inches.

Expanse of wings, ♂ ♀, $1\frac{8}{10}$ inch.

Hab. British New Guinea.

MARGARONINÆ.

Margaronia pallidalis, nov.

♂ ♀. Palpi chestnut-colour, its underside pure white; head and collar chestnut, body and legs white, fore tibiæ with chestnut bands: wings pure glistening white, fore wing with a deep costal chestnut band, inwardly marked by a black line, broken in places, with a black spot above the upper end of the cell: hind wing with a black spot at the end of the cell; both wings with black, lunular, marginal spots; cilia tinged with ochreous.

Expanse of wings, ♂ ♀, $1\frac{1}{2}$ inch.

Hab. Mt. Kebea, 3600 feet; Ekeikei, 1500 feet; Mafalu, 6500 feet: British Central New Guinea.

Margaronia silvicolalis, nov.

♂ ♀. Head, body, and fore wing much as in *M. stolalis*, Guen., but the white central and discal bands are much broader and the chocolate portions much paler and clearer; the hind wing is, however, quite differently marked, the band on the outer marginal area being narrow and composed of two narrow pale chocolate bands, lined with fine dark chocolate lines, the inner band being often nearly white; there is a little thickening of the chocolate colour at the apex.

Expanse of wings, ♂ ♀, $1\frac{7}{10}$ inch.

Hab. Ekeikei, 1000 feet.

A uniformly larger insect than *stolalis*, very nearly as large as *agathialis*, Walker, from Australia. I have three pairs, all from Ekeikei.

LVII.—*Descriptions of Two new Mollusca of the Genera Leptothyra and Mitra.* By G. B. SOWERBY, F.L.S.

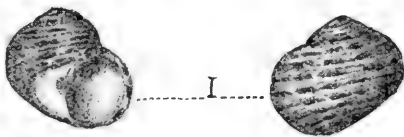
Leptothyra fultoni, Sowerby, sp. n.

Testa minuta, umbilicata, globosa, solidiuscula, rotundata, spiraliter anguste costata, lineis spiralibus nigro-fuscis interruptis ornata; spira brevis, apice obtusa; anfractus 4, convexi, rotundati, sutura impressa sejuncti; anfractus ultimus globosus, dextrorsum leviter obliquus, in regione umbilicalis albo callosus; umbilicus parvus, profundus, circularis; apertura leviter obliqua, rotundata, intus margaritacea; peristoma acutum, columella vix incrassata. Operculum calcareum, album, tenue, planum, læve.

Lat. $2\frac{1}{2}$, alt. $2\frac{1}{2}$ mm.

Hab. Aden.

This pretty little shell is chiefly distinguished by its dark brown interrupted spiral lines and narrow spiral ridges. Compared with the New Caledonian *Turbo lætus* (Montr.) it is much smaller and rather less solid; its spiral ridges are less numerous and narrower.



Leptothyra fultoni, Sowerby, sp. n.

Mitra fidis, Sowerby, sp. n.

Testa subovata, solidiuscula, ventricosa, pallide cinnamomea, griseo-fusco variegata, glabra, longitudinaliter lirata; spira acuta, mediocriter elata; anfractus 6, levissime convexi, sutura anguste canaliculata sejuncti; anfractus ultimus $\frac{2}{3}$ longitudinis testæ æquans, convexus, infra attenuatus, haud striatus; apertura latiuscula, intus lævis, griseo-fusca; peristoma acutum, læve, leviter incrassatum, arcuatum, postice anguste sinuatum; columella leviter callosa, fusca, quadriplicata, plicis crassiusculis, leviter obliquis; canalis brevis.

Long. 14, lat. 7; apert. long. 9, lat. 3 mm.

Hab. South Africa.

This shell is in form very like *M. patula*, Reeve, from which it is distinguished by having numerous prominent longitudinal folds or liræ, which are smooth, rounded, and very slightly arcuate. Having seen a considerable number

of specimens of this form, I think it well that it should have a specific name, although it has hitherto been placed as an unnamed variety of *M. patula*, which is a smooth shell, without any signs of longitudinal liræ.



Mitra fidis, Sowerby, sp. n.

LVIII.—On the Lamellicorn Coleoptera of Larat Island.
By GILBERT J. ARROW.

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DURING a visit to Larat Island, in the Tenimber Group, between Timor and New Guinea, in 1907, Mr. F. Muir made a collection of beetles which is probably the most complete yet brought from that island, and strikingly illustrates the immense number of yet unknown forms awaiting collectors in the innumerable islands of the great archipelago. Most of the families represented in the collection remain still unworked, but those which have been studied by experts contain a considerable proportion of new species. A few of these have already been described by different specialists, and I now give an enumeration of the Lamellicornia. Two species received by the British Museum from other sources have been added. The Lucanidæ, of which there are several species, are not yet identified.

Passalidæ.

Gonatas naviculator, Perch.

Gnaphalocnemis monticulosus, Smith. Found by Dr. H. O. Forbes in 1883.

Scarabæidæ.

GEOTRUPINÆ.

Bolboceras loweri, Blackb., var. *laratinum*, nov.

HYBOSORINÆ.

Phæochrous emarginatus, Cast.

COPRINÆ.

Onthophagus laratinus, sp. n.

MELOLONTHINÆ.

Idiapogonia, gen. nov., *laratina*, sp. n.

Lepidoderma pica, sp. n.

RUTELINÆ.

Parastasia vittata, Voll.

Anomala sp. n.

Adoretus sp.

A. sp.

The last three species, although probably undescribed, are represented only by female specimens, and therefore their description is not at present advisable.

DYNASTINÆ.

Dipelicus nasutus, Bates.

CETONIINÆ.

Dilochrosis parvula, Moser.

Pæcilopharis lævipennis, Kraatz.

P. minuta, Moser.

Glycyphana mollendorfi, Flach.

G. disparilis, sp. n.

Protatia adspersa, Moser.

Clinteria dimorpha, sp. n.

The new species are here described. The types are in the British Museum.

Bolboceras loweri, Blackb., var. *laratinum*.

Rufo-castaneum, subtus dense fulvo-pubescent; corpus globosum, nitidum, capite grosse inæqualiter punctato, clypeo fere semi-circulari, margine toto reflexo, parte antica absque carinis obliquis, carina postica lata, paulo arcuata, utrinque paulo acuminata, labro antico subtiliter emarginato; pronoto toto marginato, dorso lævissimo, dimidio antico late excavato et punctato, postico medio vix sulcato, punctis nonnullis minutis, lateribus fovea profunda punctisque sparsis impressis; elytris subtiliter punctato-striatis, punctis minutis, haud remotis, intervallo suturali lato, convexo, reliquis angustis, fere planis.

Long. 10–11.5 mm.; lat. max. 6–7 mm.

The two specimens found by Mr. Muir are interesting as the first examples of *Bolboceras* proper found in the Malayan or Papuan Region. They differ from the type of *B. loweri* from North Queensland in the anterior declivity of the

clypeus being without the two diverging ridges and the frontal carina wider. In the Australian form the latter is one-third the width of the clypeus, and in the present variety one-half.

The distribution of the large and curious genus *Bolboceras* is exceedingly interesting. Widely scattered through the Old and New Worlds, it is well represented in India, and reaches its highest development in Australia, where the species are more numerous and attain larger and more striking forms than in any other part of the world. It might, therefore, be expected that it would also be found distributed through the chain of islands that connects the two continents; but this is not the case. The little group of species separated from *Bolboceras* by M. Boucomont under the name of *Bolbochromus* occurs in Java, Borneo, Sumatra, and Celebes, but no true *Bolboceras* is known from that region, and no member of the family has been hitherto known from the Papuan Region. The present apparent exception is evidently a straggler from Australia, and not a link with Oriental species. We must conclude, therefore, that these insects have not entered Australia from that region, but belong to the primitive fauna of the country. This is confirmed by the fact that, as in the case of many other peculiar Australian animals, the nearest allied forms are to be found in America—a group of species of *Bolboceras* occurring in Chili which is quite unconnected with the other American species, but has evident affinities with the Australian.

Oonthophagus laratinus, sp. n.

Niger, nitidus, capite et prothorace leviter cupreis, pedibus antennisque rufo-piceis, harum clava nonnunquam flava; late ovatus, parce setosus, capite haud dense, subrugose punctato, nitido, antice obtuse bidentato; pronoto fortiter inæqualiter punctato, modice convexo; elytris subtilissime coriaceis, striatis, striis vix punctatis, interstitiis sat remote punctatis, punctis breviter setiferis, interstitiis alternis longitudinaliter carinatis, carinis nitidis, punctis setiferis interruptis; pygidio parce longius setoso:

♂, clypeo paulo longiori, postice leviter transversim tuberculato, vertice bicornuto, cornubus fere rectis, leviter divergentibus, retrorsum inclinatiss, basi intus paulo dilatatis; tibia antica apice truncata, paulo inquinata, haud calcarata, lateraliter tridentata et serrata:

♀, vertice bituberculato, tibia antica lateraliter acute quadridentata, apice fortiter calcarata.

Long. 8–9 mm.; lat. max. 4–5.5 mm.

Three males and two females of this were found by Mr. Muir. The sculpture of the elytra is quite peculiar and unlike that of any other species known to me. There is a microscopic reticulation of the surface, which, in the male, where it is rather less fine than in the female, produces a semiopaque effect, at least upon the inner part. The sutural and alternate intervals bear smooth shining carinæ along the middle, interrupted at intervals by large punctures bearing minute erect bristles. The intervening flat intervals also bear rather more numerous bristle-bearing punctures, and the head and pygidium are clothed with longer and more conspicuous, though very scanty, erect bristles. The pronotum is moderately convex, unarmed and simple in both sexes, but less strongly punctured in the male, and the vertex in the latter sex bears two straight separate horns inclined backwards.

IDIAPOGONIA, gen. nov.

Corpus parvum, paulo elongatum. Oculi modice prominentes. Clypeus haud brevissimus, antice fere rectus, lateraliter rotundatus, sutura leviter curvata. Antennæ 8-articulatæ, articulo 2° globuloso, 3° et 4° minutis, elongatis, 5° conicali, 6°-8° lamellatis, lamellis brevibus. Labrum sat magnum, valde emarginatum. Mandibulæ breves, apice acuminatæ. Maxillæ crassæ, apice valde 5-dentatæ, palpis simplicibus. Mentum elongatum, oblongum, extus valde convexum, apice emarginatum, palpis geniculatis, articulo penultimo valde arcuato. Epimera metathoracica triangulares. Coxæ intermediæ obliquæ. Tibiæ 4 posteriores breves, extus carina setigera munitæ. Tarsi subtus pilosi, articulo primo longo. Ungues appendiculati, haud fissi, intus pulvillo late lobato et piloso instructi.

♂. Tarsi antici et intermedii dilatati, subtus dense pilosi. Elytra pruinosa.

Idiapogonia laratina, sp. n.

Nigro-picea, corpore subtus rufescenti; modice convexa, clypeo grosse et crebre punctato, margine reflexo, vix sinuato, fronte prothoraceque fortiter punctatis, hujus lateribus arcuatis, angulis anticis acutis, posticis obtusis, basi leviter trisinuato; scutello punctis minutis nonnullis prædito elytrisque distincte æqualiter et sublineare punctatis; pygidio grosse et subrugose punctato, flavo-setoso; tibiis anticis bidentatis.

Long. 6.5-8 mm.; lat. max. 3.5-4 mm.

A male and two females were collected by Mr. Muir.

This little insect has many peculiar features which separate it rather widely from all other known genera. The great

development of the pulvillus as a broad setose lamina, particularly as it occurs in combination with claws furnished with broad laminae at the base, is, so far as I know, unique amongst the Melolonthinae. The antennae are of peculiar structure, the joints being reduced in number to eight, and the three composing the club broader at the base and less closely fitting than usual. The mandibles are small, with a large molar at the base, and the maxillae are powerfully developed. The mentum is very tumid beneath, and the labial palpi have the penultimate joint curiously bent, giving the organs an elbowed form. Finally, the sexual differences are interesting, the male having a silky bloom upon the elytra, in addition to dilated and velvety front and middle tarsi, as in *Apogonia* and other genera.

Lepidoderma pica, sp. n.

Nigra, nitida, elytris minus nitidis, postice fasciis duabus oblique transversis (interdum intus connexis) nonnunquam etiam maculis minoribus anterioribus albo-squamosis; capite grosse punctato, sat longe fulvo-piloso, pronoto glabro, hic ibique minute punctato, antice parce fulvo-piloso, prope margines squamis albis irregulariter sparsuto, lateribus in medio obtuse angulatis, angulis anticis fere rectis, posticis acutis; scutello laxe punctato, margine angulisque anticis setosis; elytris minutissime et densissime punctulatis, singulo areis duabus laevigatis; propygidio dense setoso, pygidio ruguloso, nudo; pectore dense flavo-piloso, medio laevi, lateribus albo-squamoso; abdomine medio polito, lateribus quinque-fasciatis, fasciis dense albo-squamosis.

Long. 29-33 mm.; lat. max. 15-17 mm.

This is a very distinctively marked species, being entirely black, with white scales which form two transverse, slightly oblique bands upon the hinder half of each elytron, nowhere reaching the margin. These bands are of variable size, and in one specimen are united at their inner ends by a straight line of scales near the suture and parallel to it. The pattern thus produced is repeated in this specimen by a similar figure just in front, but smaller. In others this is represented by a few scales only. The pygidium is almost without scales, the propygidium closely setose, and the abdomen smooth and shining in the middle and finely punctured at the sides, where there are five transverse bars of dense white scales. The pronotum is very shining and the elytra are subopaque.

The male has the antennae rather longer than the female, the club consisting of five instead of four joints, and the tarsi are distinctly longer.

L. pica possibly resembles *L. nigra*, Nonfr., but the

pygidium of the latter is said to be closely scaly and the pronotum densely punctured, and no pattern formed by the scale-distribution is described.

Glycyphana disparilis, sp. n.

Obscure olivaceo-viridis vel nigro-viridis, plus minusve albido-maculata, corpore depresso, elongato, lateribus post medium fere parallelis, pronoto undique punctato, elytris profunde punctato-striatis:

♂, corpore supra opaco, capite corporeque subtus nitidis, illo minute albido-punctato, hoc utrinque transversim fasciato; pronoto punctis utrinque 3-9 sat minutis, sparsutis, nonnunquam partim confluentibus, ornato; scutello basi bi-, apice unipunctato vel immaculato; elytris punctis minutis inconstantibus plus minusve confluentibus ornatis; pygidio albido, macula mediana trilobata nigra:

♀, corpore nitido, elytris sericeis pygidioque dense et brevissime flavo-setoso; pronoto grosse et profunde punctato; elytris ut in mari albido-maculatis aut immaculatis.

Long. 14-17 mm.; lat. max. 8-9 mm.

Mr. Muir took a series of six males and four females of this species, which is remarkable for the striking difference in appearance between the sexes. The male resembles that of *G. felina*, G. & P., but the prothorax is relatively shorter and the scutellum and elytra are distinctly longer than in that species. The pale markings of the upper surface are similar, but generally less crowded and without the marginal lines appearing in *G. felina*. There are large white patches on each side of the body beneath, including a broad bar on each ventral segment but the last.

In the female the whole body is shining except the elytra, which are dull, and the pygidium, which is finely and densely rugulose and clothed with very short, erect, yellow setæ. The elytra usually exhibit a few small scattered pale spots.

Clinteria dimorpha, sp. n.

Fusco-ænea vel cuprea, corpore subtus nitido, capite prothoraceque irregulariter punctatis, clypei margine paulo exciso; prothorace sat angusto, angulis posticis rotundatis; elytris punctato-striatis, angulis apicalibus rotundatis; processu mesosternali acuminato, vix producto:

♂, corpore supra opaco, prothoracis margine laterali interrupto, punctis 2 discoidalibus minutis lobique posticalis vitta brevi, elytrorum macula triangulari mediana, punctis 2 geminatis prope

marginem externum, alio prope marginem internum lunulaque apicali, pallide flavis vel albidis; pygidii maculis 3 vel 4 corporisque subtus lateribus fasciis transversis ornatis; tibia antica dentibus duobus acutis tertioque minuto remoto armata.

Long. 12.5-15 mm.; lat. max. 6.5-7.5 mm.

In the above diagnosis I have described the male only, because, although I have little doubt that I have rightly associated the very different forms I regard as the male and female, the evidence is not yet conclusive.

The male is like *C. forbesi*, Jans., but the sternal process is shorter, the sutural angles of the elytra are not sharp, and the pale markings are different. Three male specimens found by Mr. Muir are practically identical in their markings, which consist of an interrupted lateral margin to the pronotum, a spot upon the basal lobe, and two minute discoidal spots, and upon the elytra a triangular mark near the middle of each, a comma-like spot near the suture behind, a large and a small spot between the two last but near the outer margin, and an apical lunule.

The two female specimens are superficially entirely different. The pronotum is shining and the pale markings are absent from the upper and lower surface alike, except that in one specimen there are two minute spots upon each elytron. The front tibiae are short and broad and armed with three blunt equidistant teeth, and the hind tarsi are shorter than those of the male.

I believe no well-marked sexual dimorphism has hitherto been recorded in the genus *Clinteria*, and the remarkable parallelism between the present case and that of *Glycyphana disparilis*, in which the sexes differ in exactly the same way, is very suggestive. It is natural to suppose that some kind of local influence is responsible for the occurrence of the same phenomenon (not of a usual kind) in two different genera inhabiting the same place.

LIX.—*Two new Australian Diptera.*

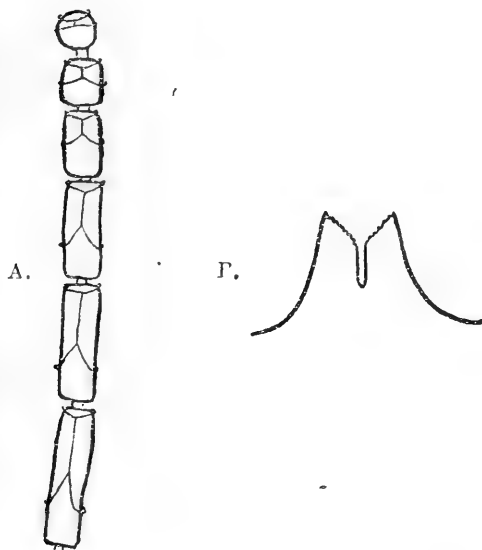
By F. W. EDWARDS, B.A., F.E.S.

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Asphondylia hilli, sp. n.

Adult ♀.—*Eyes* very large, contiguous above for a long distance, leaving only a triangular vertex and a very small

space above the antennæ. Vertex blackish, clothed with rather long and dense black hair. *Palpi* two-jointed (apart from the palpiger), the joints about equal in length, five or six times as long as broad. *Antennæ* dark brown, two-thirds as long as the whole body, clothed with short pale hair. First scapal joint about twice as long as broad, second globular; first flagellar joint cylindrical, six times as long as broad; second to eighth cylindrical, equally long, four times as long as broad; ninth three times, tenth nearly twice, and



A. *A. hilli*. Apex of antenna, to show circumfili.
 B. *A. hilli*. Cervical armature of pupa.

eleventh scarcely more than as long as broad, all cylindrical; twelfth globular, rather less in diameter than the eleventh. All the flagellar joints have an "arcuated thread" round the tip, connected with a second at about one-third the distance from the base. *Thorax* dark greyish brown, dull, with two lines of long yellowish hairs, mixed with some dark ones; patches of dark hair on the humeri. *Abdomen* blackish, rather densely clothed with short greyish pubescence, only about twice as long as broad. The strong needle-like ovi-

positor is not exerted in any of the specimens, and cannot be seen when they are in the dry state ; in the mounted specimen, however, it is conspicuous and is about half as long as the entire abdomen. *Legs* stout, clothed for the most part with dark brown scales ; on the apical half of the hind tibiæ and the whole of the second hind tarsal joint, however, these scales are light greyish. The empodia are slightly longer than the stout black claws. *Wings* appearing blackish owing to their dense hairy covering, the tips of the veins somewhat darker than the remainder of the wing. *Halteres* blackish, base of stalk yellowish.

Length of body 3 mm. ; antenna 2·2 mm. ; wing 2·8 mm.

Pupa.—Rather dark brownish in colour. Cervical armature as in the diagram, the anterior edges finely serrate. Four facial teeth ; one large one in front and a group of three rather smaller ones behind, two of which are some distance in front of the third. The anterior half of each abdominal segment bears numerous irregularly arranged backwardly directed spines, while situated at about two-thirds of the distance across each segment is a regular transverse row of about 20 spines.

Gall.—Glandular, on the surface of the stem of an undetermined plant ; very much resembling that figured by Kieffer for *Daphnephila glandifer* (Gen. Ins. Cecid. pl. ii. figs. 2 & 3), except that the individual galls are quite separate at the base ; in size the galls are 4–6 mm. long by 2–3 mm. broad, and on the piece of stem sent, which is only 3 in. \times $\frac{1}{3}$ in., there are about eighty galls. Only a single larva occupies each gall ; pupation occurs within the gall, and the pupa emerges by boring a more or less circular hole at the apex.

N. AUSTRALIA : Darwin, 11. xi. 1915 (*G. F. Hill*).

Palpomysia flagellata, sp. n.

Head shining black, front fairly broad, the eyes separated by about the width of the second antennal joint. Palpi and proboscis dark brown, the latter a little shorter than the vertical diameter of the head. Antennæ as long as the whole body ; first scapal joint small, second larger, nearly globular ; flagellar joints all cylindrical, the first about ten times as long as broad, the next nine all about equal in length, five times as long as broad, last four more elongate and more densely haired than the first ten, which have each a few stiff hairs near the base and apex. The scape of the antennæ is

blackish, the flagellum has the few basal joints yellowish brown, the remainder dark brown. *Thorax* entirely shining black, except for a narrow grey-pruinose band across the lower edge of the pleuræ; scattered black hairs but no short pubescence on the mesonotum, which has a well-marked tubercle in the middle line in front. *Abdomen* nearly cylindrical, entirely shining black. *Legs*: front coxæ and all the trochanters reddish, middle and hind coxæ shining black. Femora yellow with black tips; front and middle pairs entirely unarmed, hind pair with two bristly spines on the underside near the tip. Front tibiæ slightly enlarged before the middle, the basal half and the tip black, the remainder yellow. Middle and hind tibiæ with the basal fourth and the tip black, remainder yellow. All the tarsi with the first joint yellow; second, third, and fourth brownish; fifth whitish, claws black. First tarsal joint of front legs a little less, of middle and hind legs rather more, than half as long as the tibia; second joint about half as long as the first, third about half as long as the second; the front legs being shorter than the others, the third tarsal joint is almost globular. Fourth joint on all legs short, cordiform. Fifth joint about as long as the third, longer on the front legs, without spines beneath. Claws nearly as long as the fifth tarsal joint, simple; the front and middle pairs equal, the hind pair very unequal. *Wings* slightly greyish, unmarked. Costa to about nine-tenths of wing-length; second marginal cell more than three times as long as first; cubitus forking below base of lower branch of media. (Halteres missing.)

Length of body, without antennæ, 3 mm.; wing 2.5 mm.

N. AUSTRALIA: Stapleton, 16. iii. 1915; two females (one damaged) taken in jungle amongst small herbage (*G. F. Hill*).

This species is the first to be described from Australia of this group of Ceratopogoninæ; it is chiefly interesting on account of its elongate antennæ, with cylindrical flagellar joints; the presence of spinules on the hind femora only is also a very unusual character, and, so far as I am aware, is found in only one other species—*P. curriei*, Coq., from North America,—which, except in antennal characters, must bear a close resemblance to *P. flagellata*. The bristles on the hind femora of the new species are hardly stout enough to be called spines, and doubt might arise as to whether the species should be placed in *Palpomyia* or *Johannsenomyia*, but for the presence of a well-marked mesonotal tubercle. This tubercle has apparently been overlooked by previous workers

on this group, but I believe it forms one of the best generic characters of *Palpomyia*. It occurs in all the species of the genus which I have examined (including those of *Heteromyia*, which, in my opinion, is not properly separable from *Palpomyia*), but not in the allied genera *Johannsenomyia* and *Hartomyia*.

BIBLIOGRAPHICAL NOTICE.

The Evolution of Aquatic Reptiles.

MANY attempts during recent years have been made to set before the layman the evidences of Evolution in language devoid of technical terms. Some of these efforts have at the same time resulted in volumes which have proved most acceptable to the trained zoologist. Prof. Williston's book on 'Water Reptiles Past and Present' (The University of Chicago Press and the Cambridge University Press, London) is one of these.

The author writes with a very intimate knowledge of his subject, gleaned not merely from specimens in museums, but also from work in the field. Hence he writes with an almost deadly accuracy—so that, apart from eccentricities of spelling and grammar, which grate on English ears, the critic finds little to cavil at. But here and there we seem to catch him tripping. Thus, in describing the method by which the crocodile drowns its prey, we are told that, by reason of the extremely backward position of the posterior nares, the animal is enabled to "breathe with the mouth," while the extremity of the snout, carrying the external nares, is thrust above the water. Perhaps he merely meant to say that, by reason of the backward migration of the nares, the animal is able to breathe even while the mouth is filled with water. Again, it is scarcely accurate to describe the tortoises as animals which have developed "the strange habit of concealing themselves inside of their ribs."

The Ichthyosaurs naturally are described at length in this volume, but, curiously, no mention is made, in describing the paddles, of the posterior fin-like membrane, with its supporting rays, recalling the fin-rays of fishes.

These, however, are but small blemishes in a book brimful of interest and profusely illustrated.

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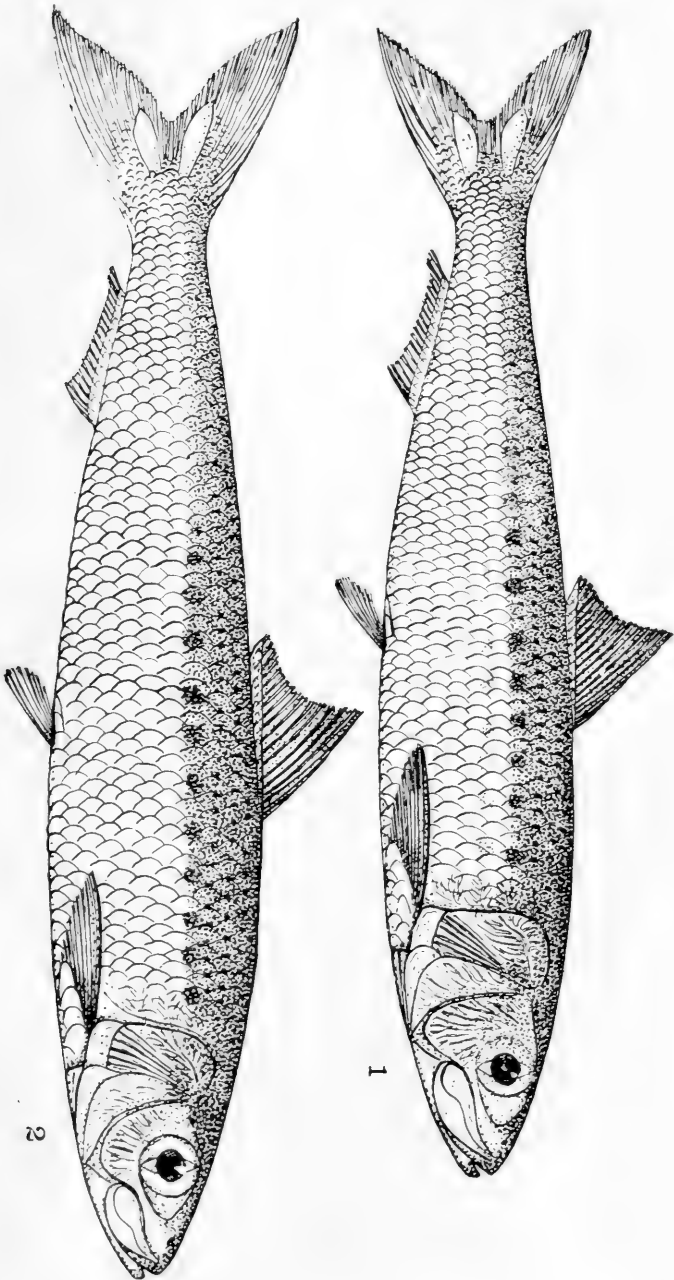
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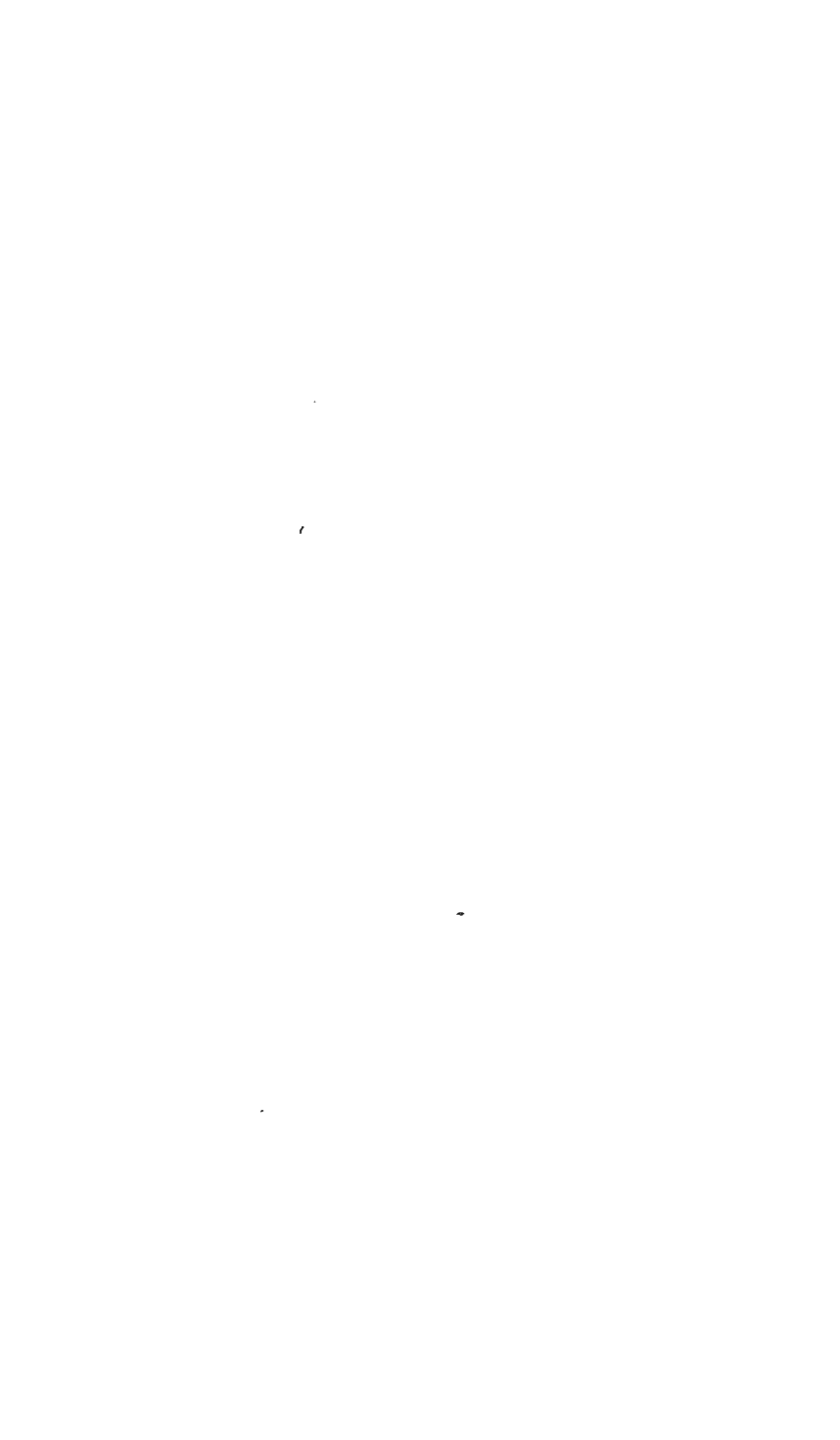
1. *Sardinia sardina*.

2. *S. neopichardus*.

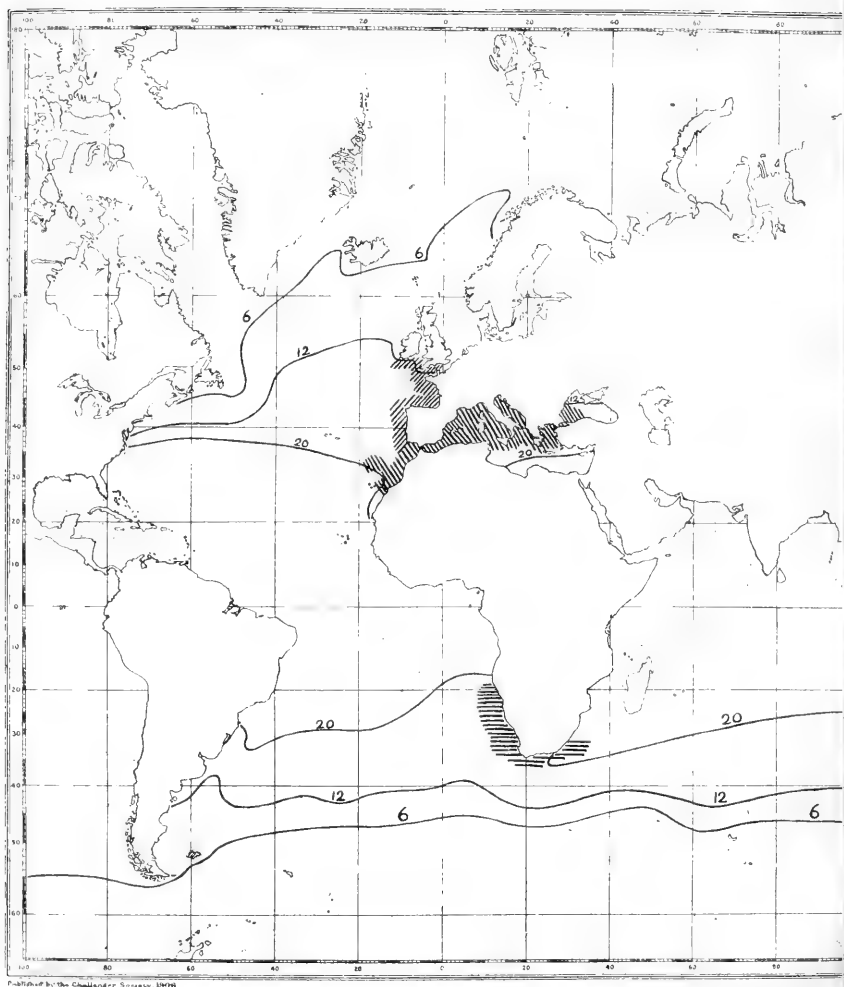


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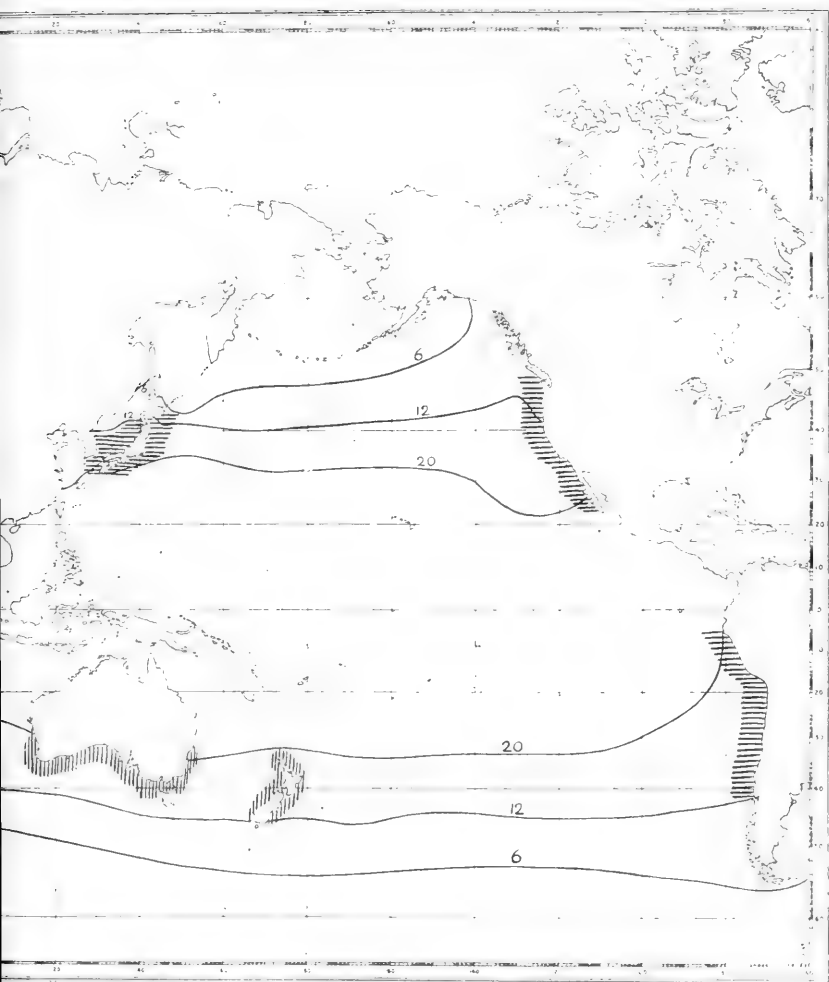


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////, *S. pilchardus*; //, *S. pilchardus sarracina*

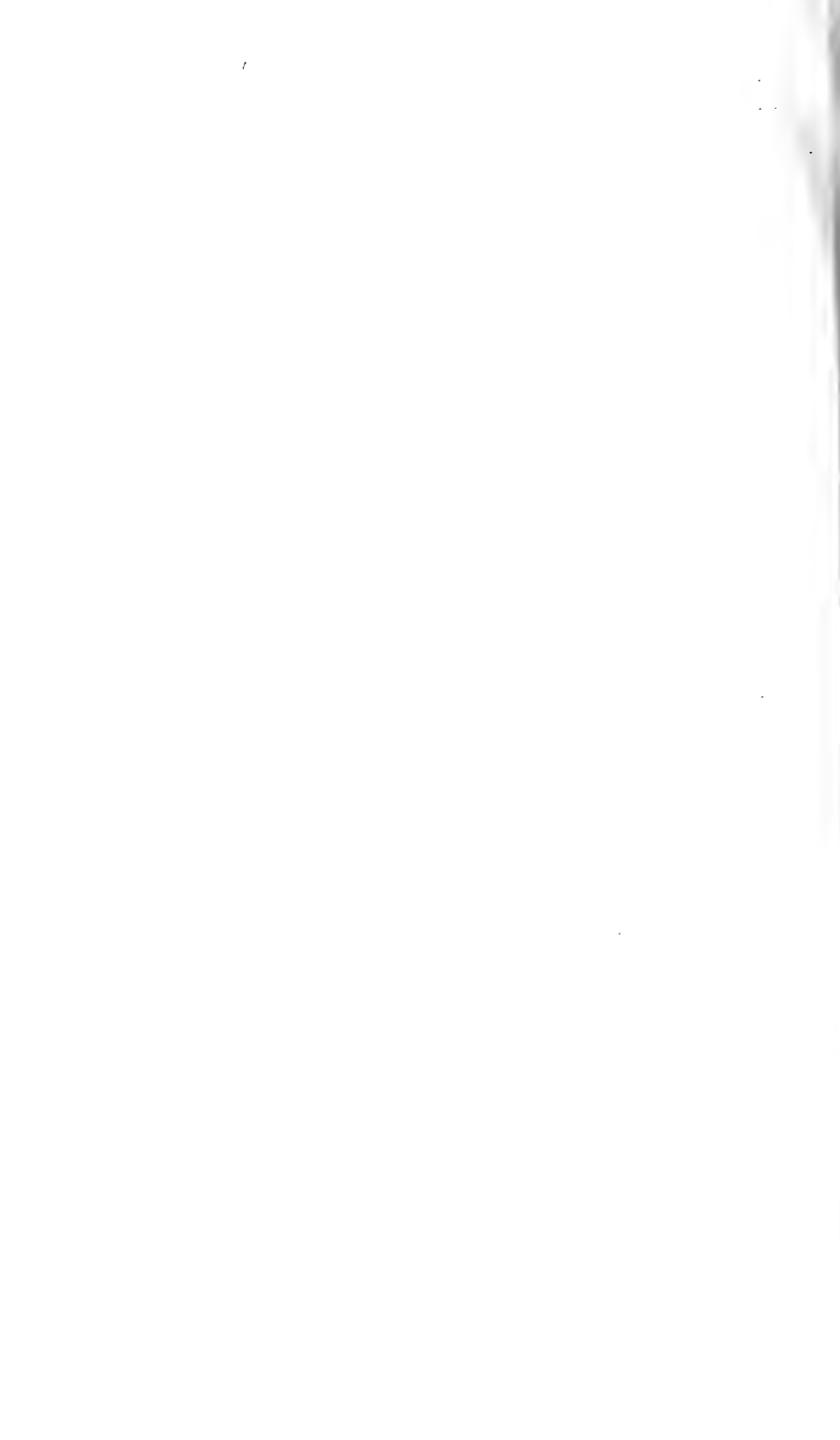
The mean annual surface isotherms



OF SARDINA

; , *S. sagax*; , *S. neopilchardus*.

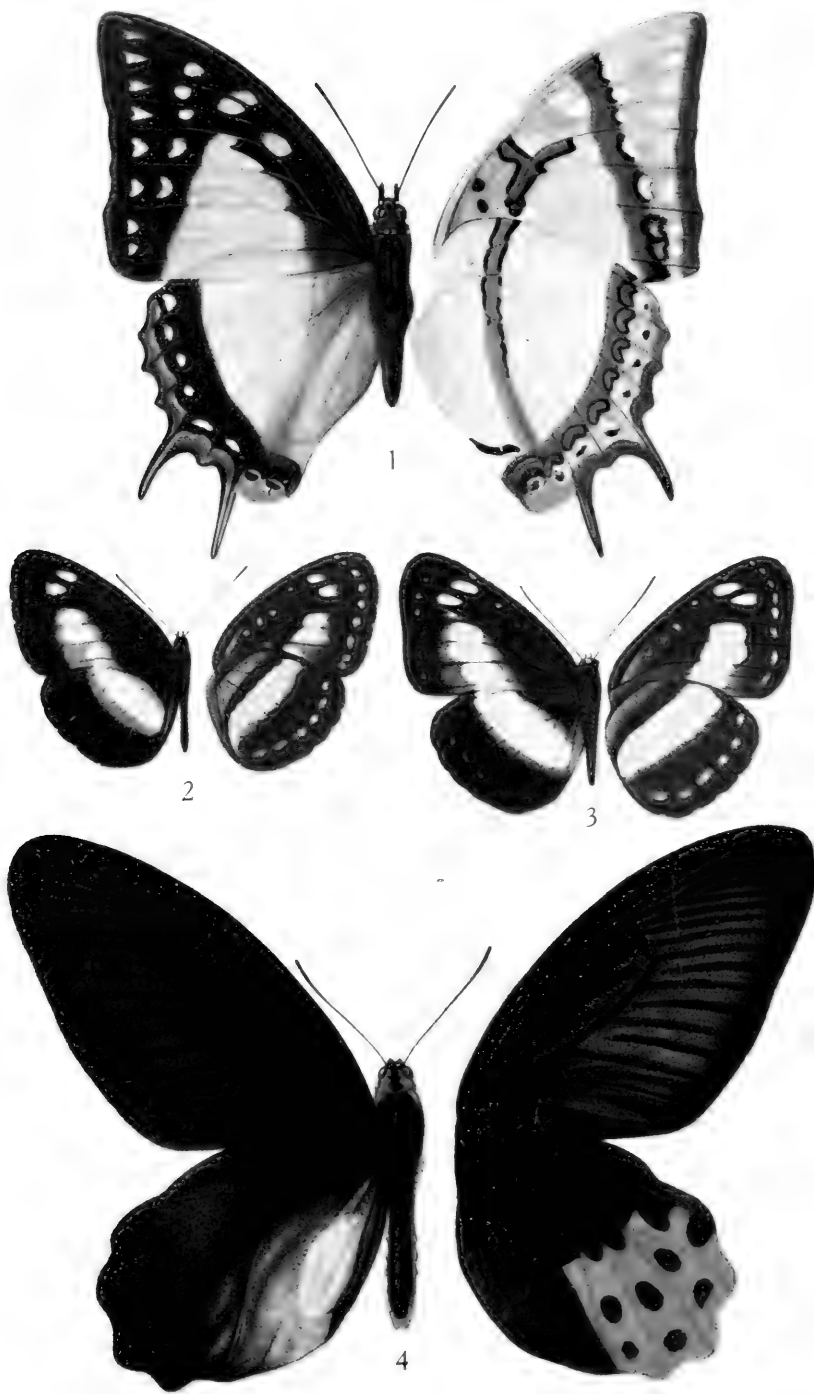
of 6°, 12° and 20° C. are shown.





NEW DELIAS FROM NEW GUINEA.





H. C. Whitfield photo.

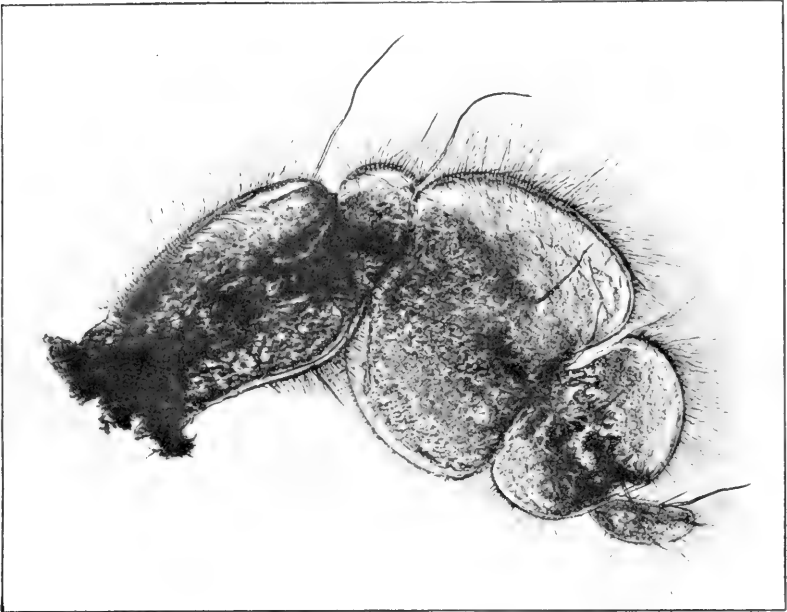


Fig. 1.—*Paragnathia hutchinsii*, ♂. Gnathopod.

H. C. Whitfield photo.

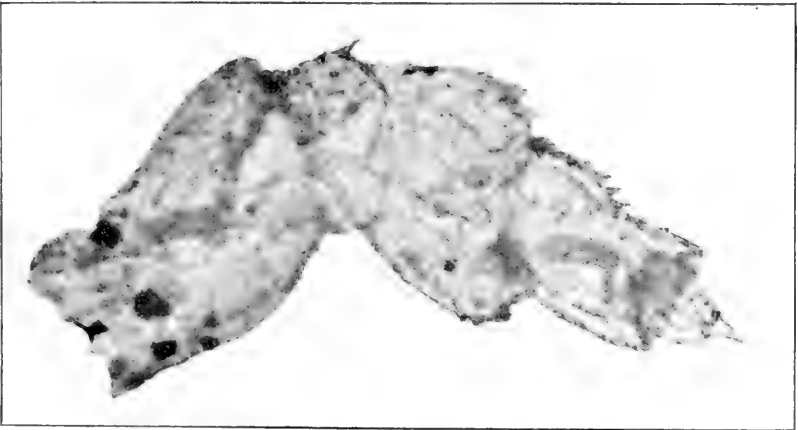


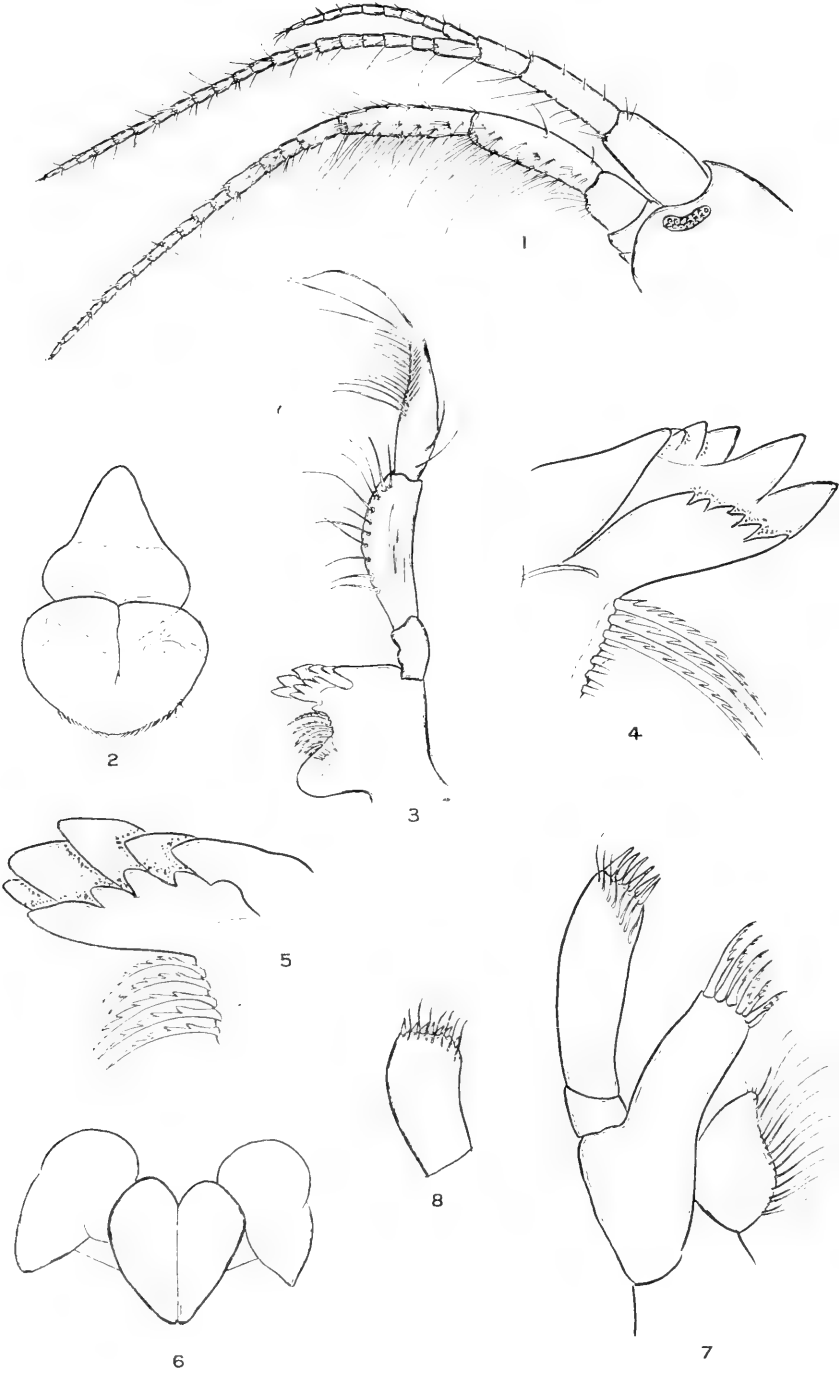
Fig. 2.—*Paragnathia hutchinsii*, ♀. Gnathopod.



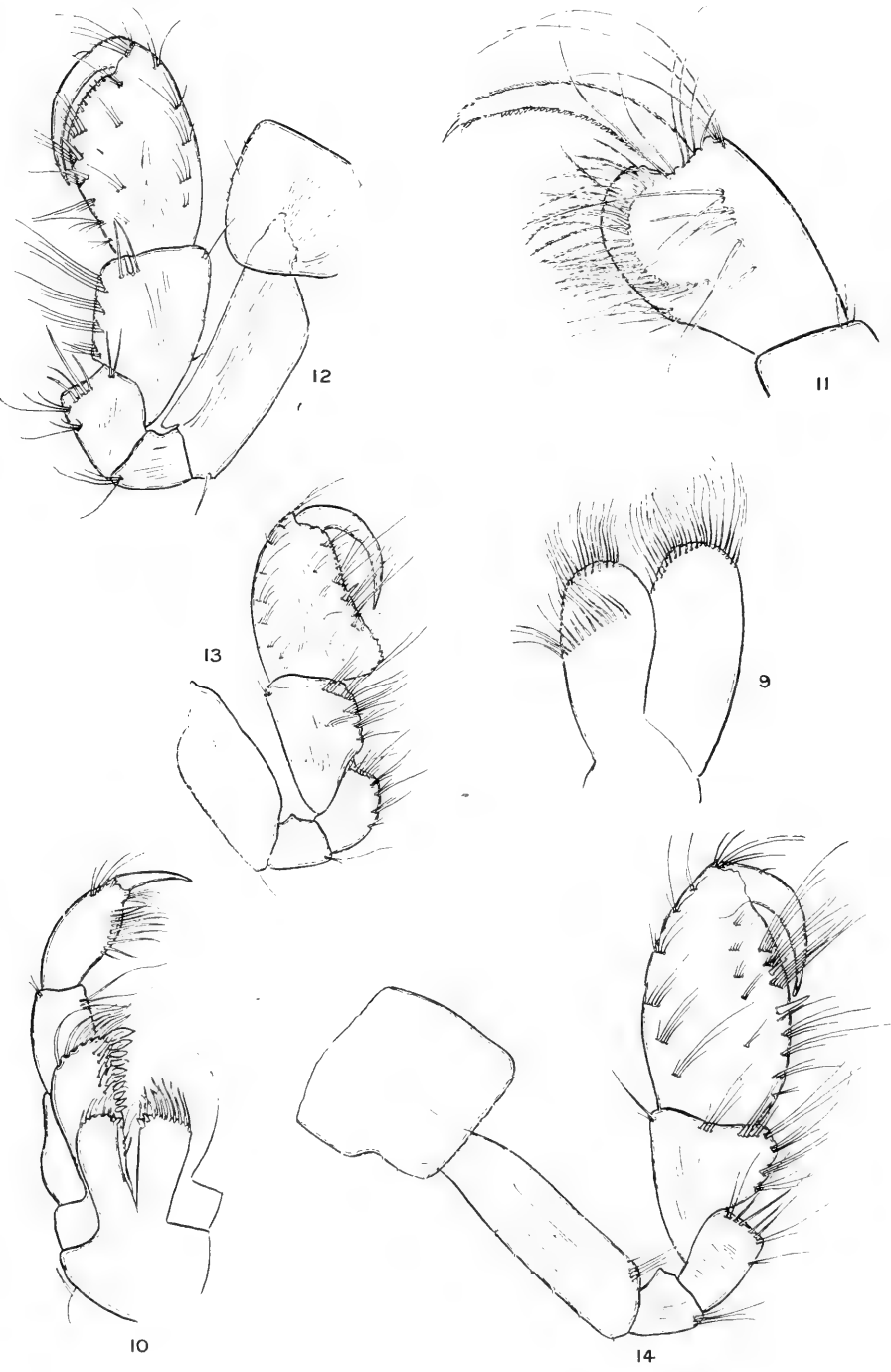


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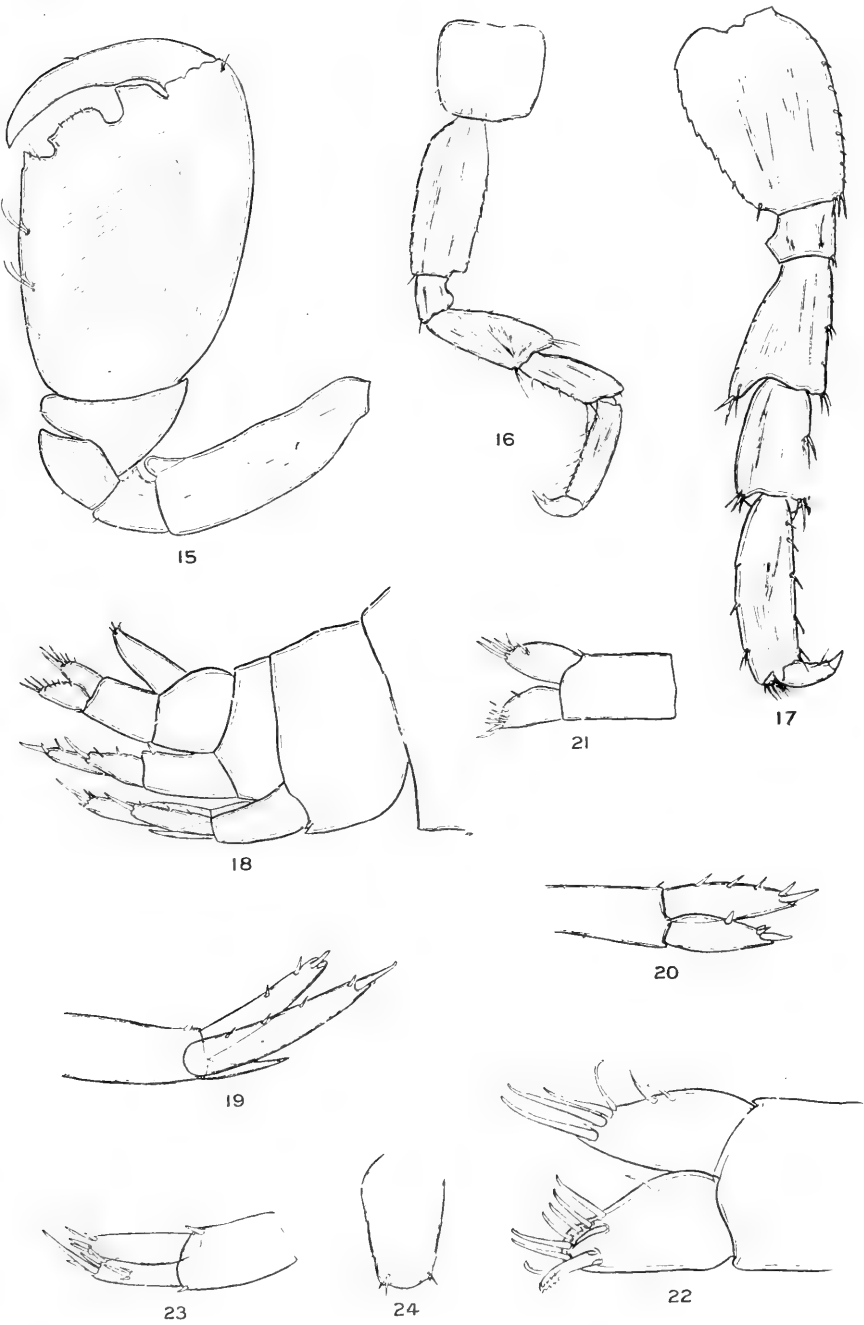


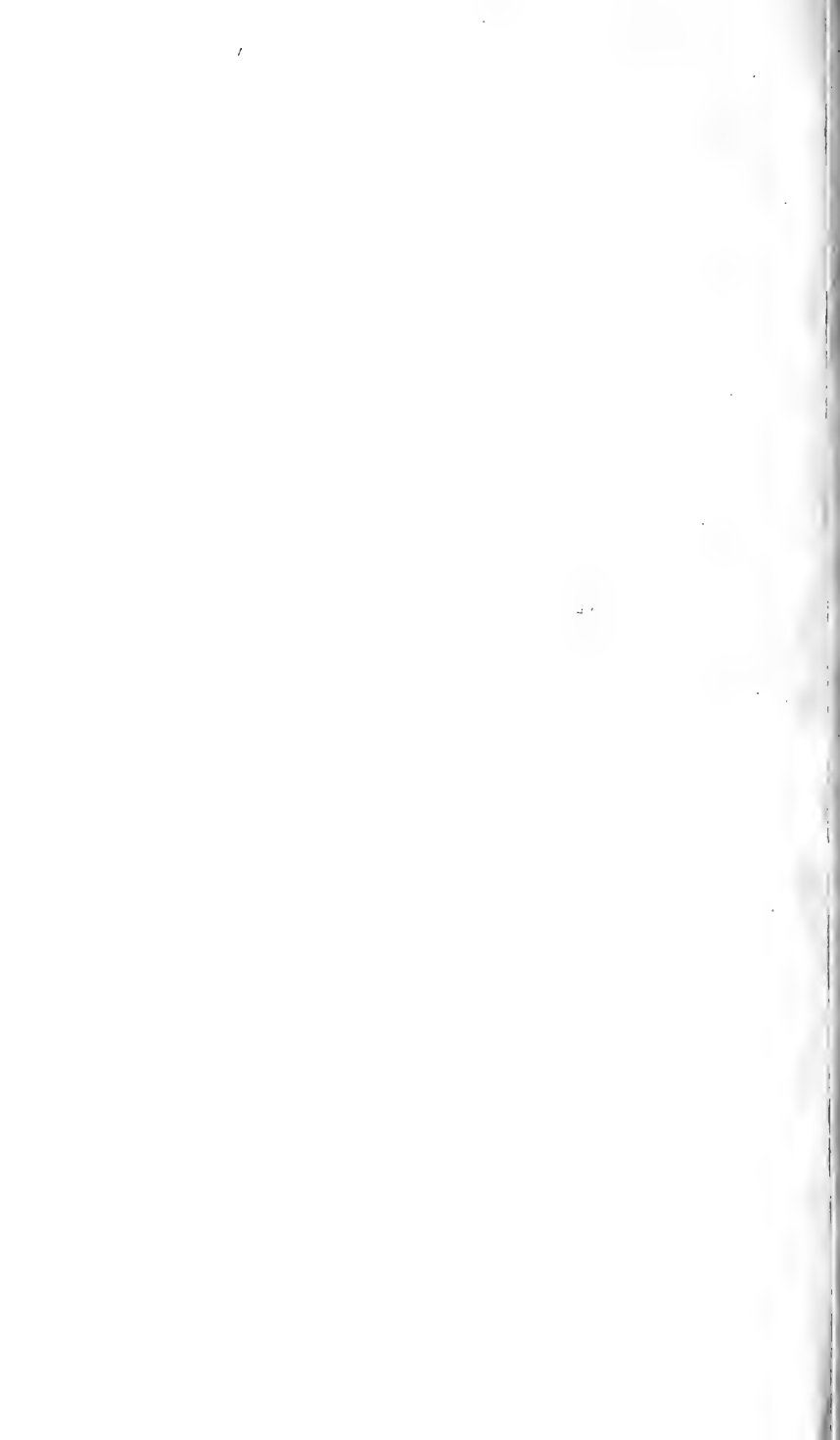


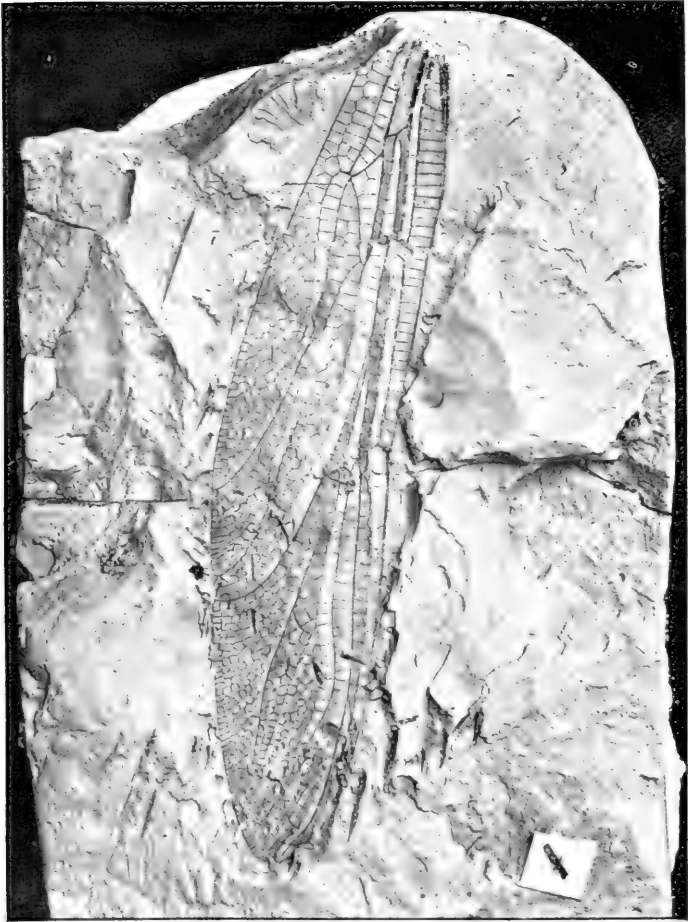








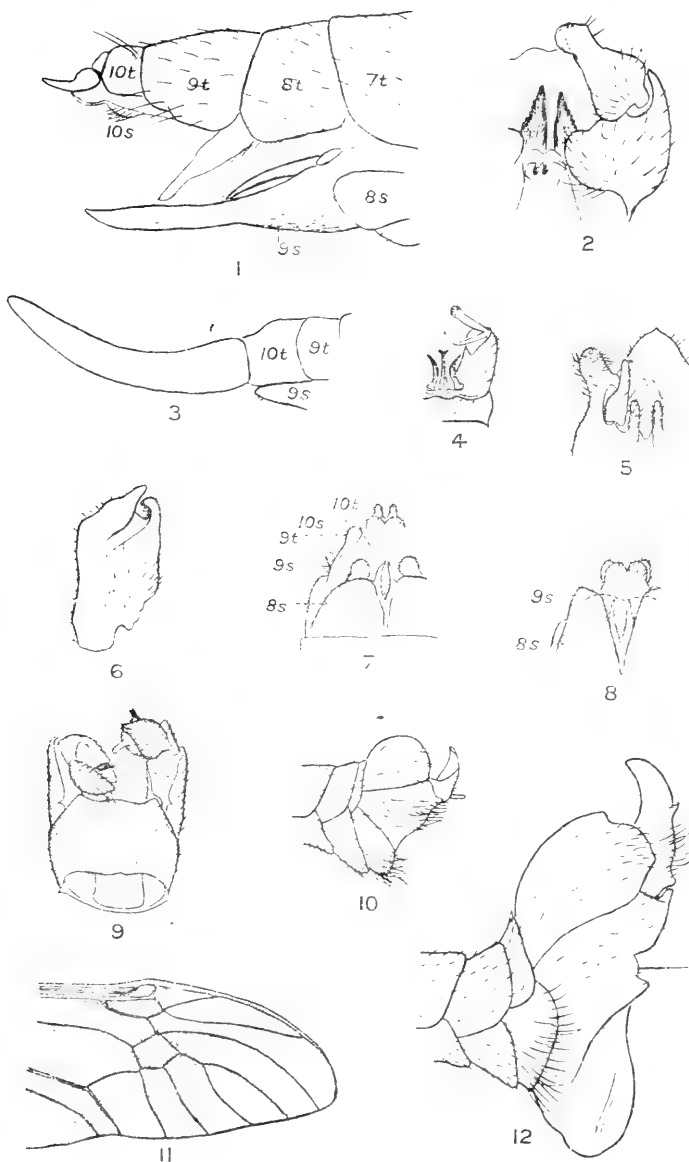


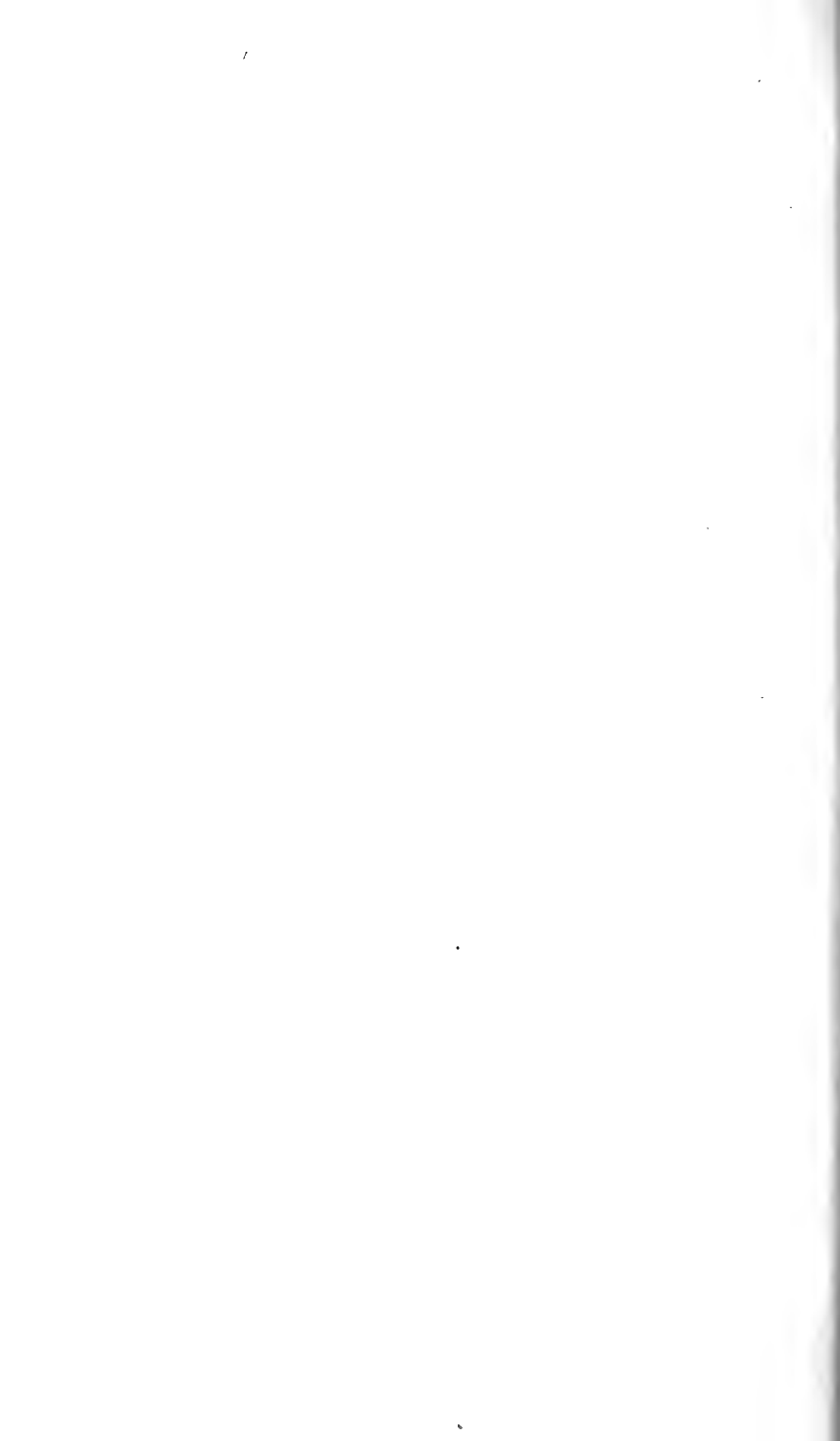


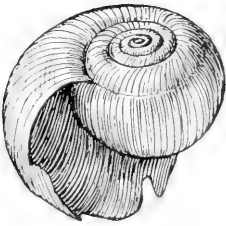
Mrs. Dudley Robinson photo.

TRIÆSCHNA GOSSI, gen. et sp. n.

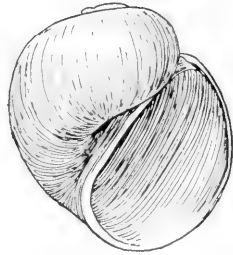








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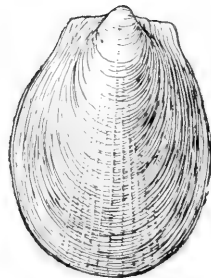
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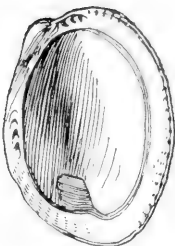
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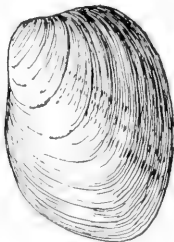
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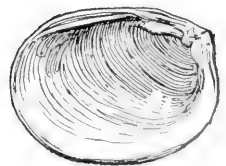
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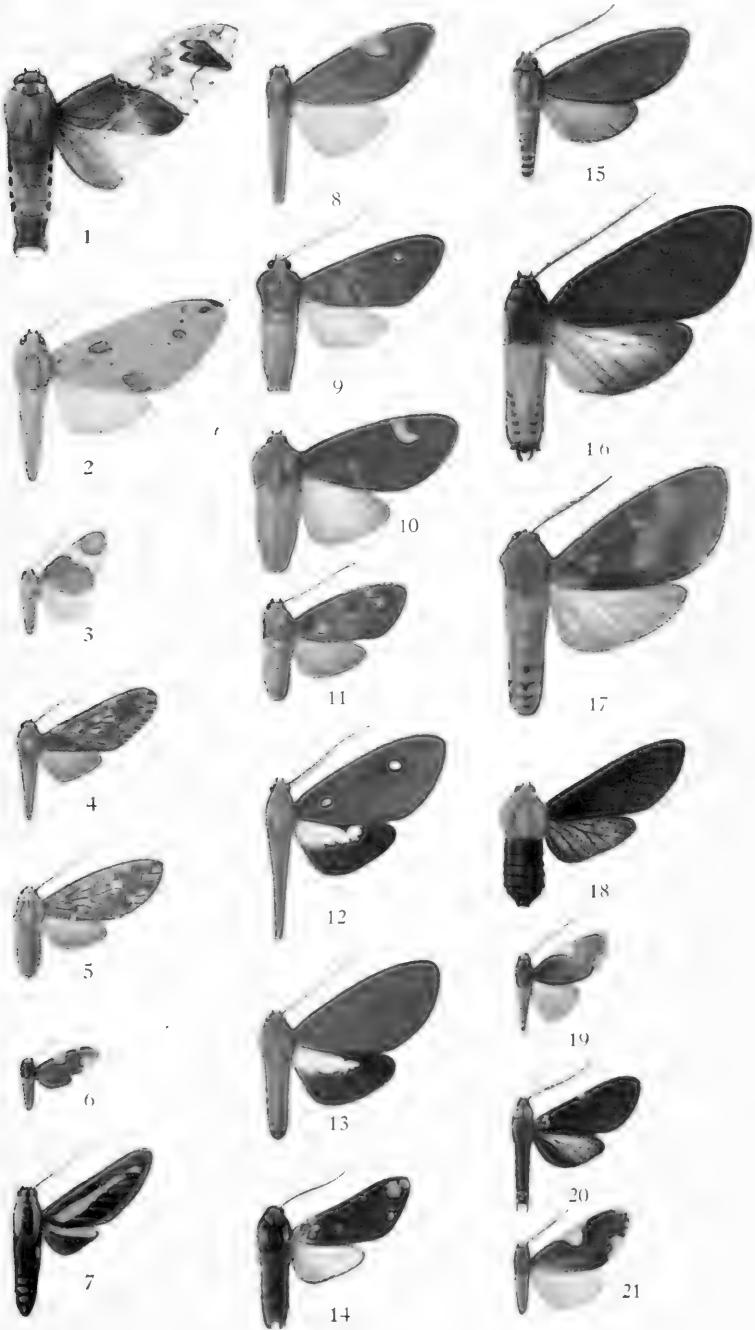


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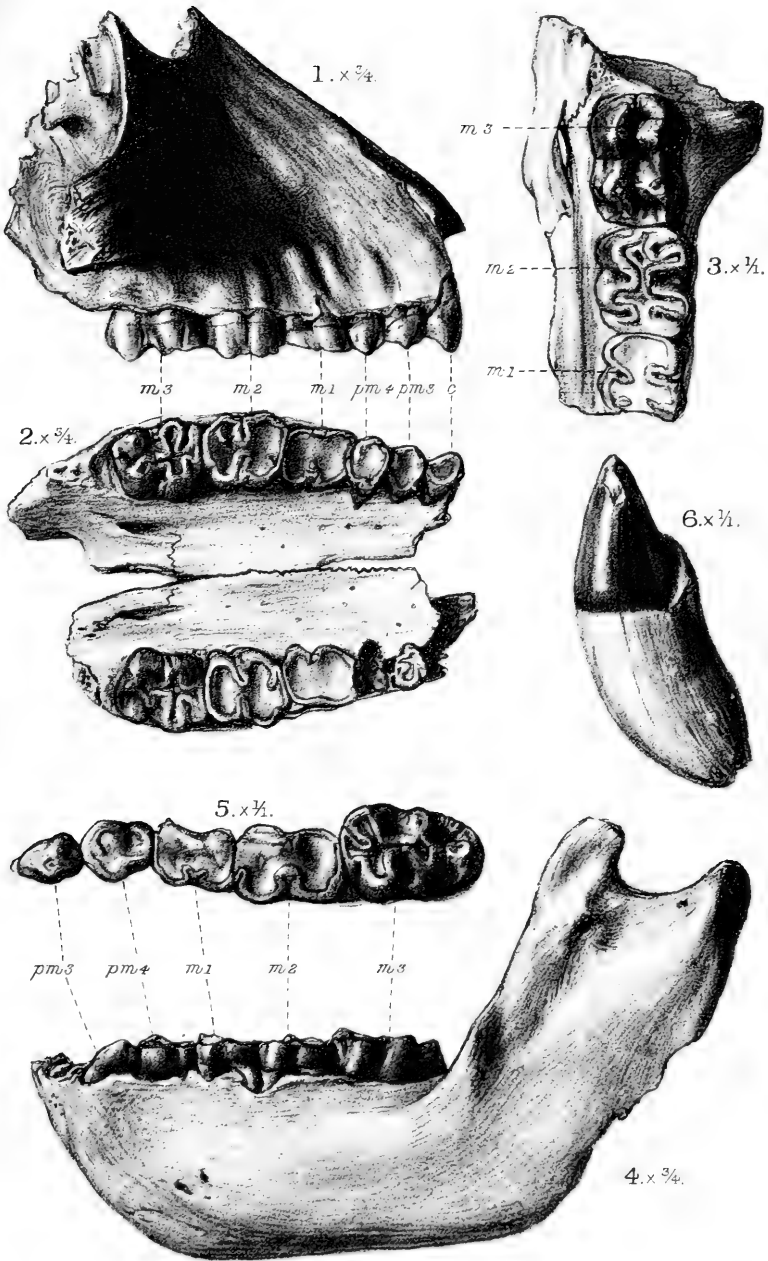




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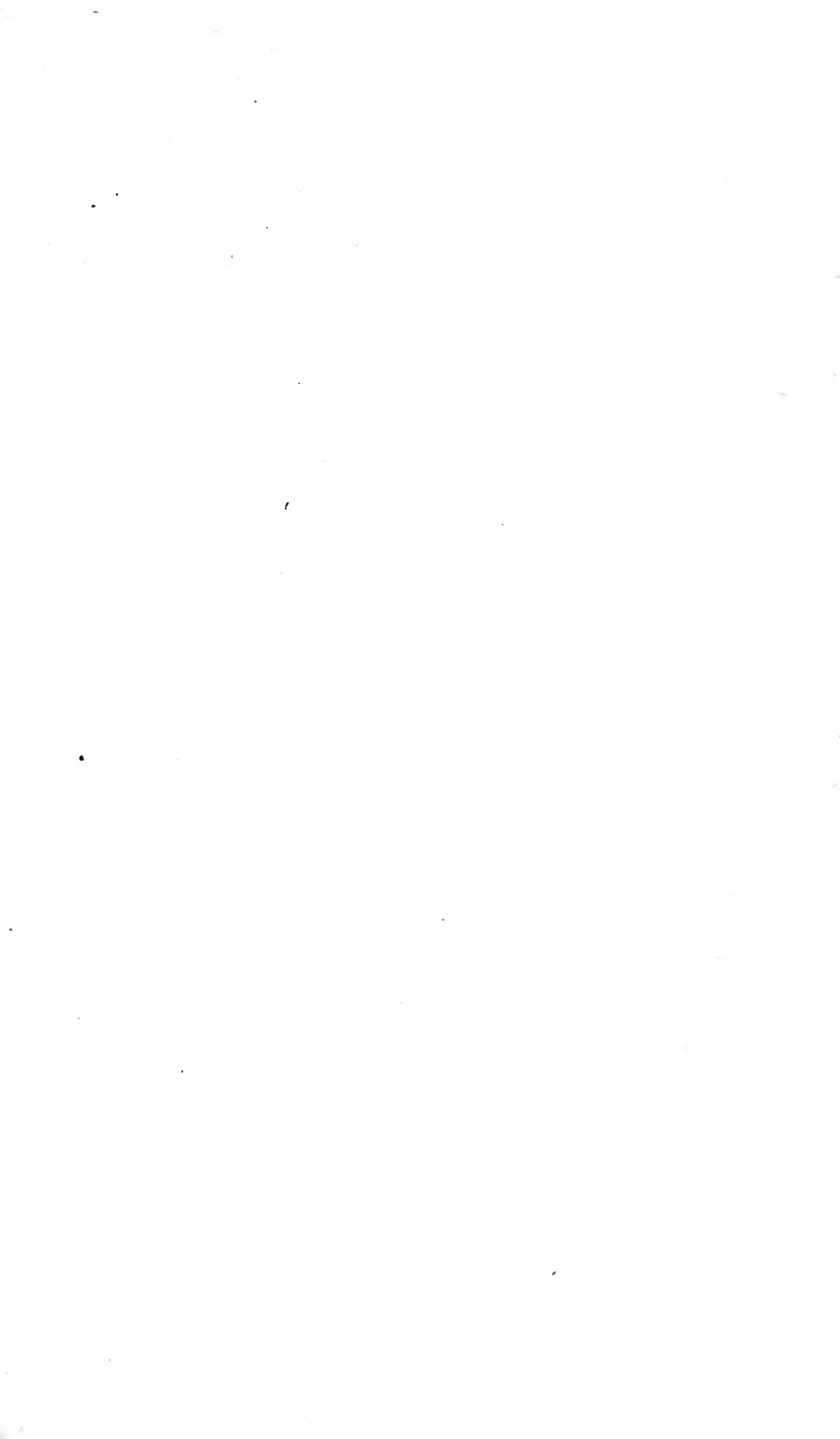
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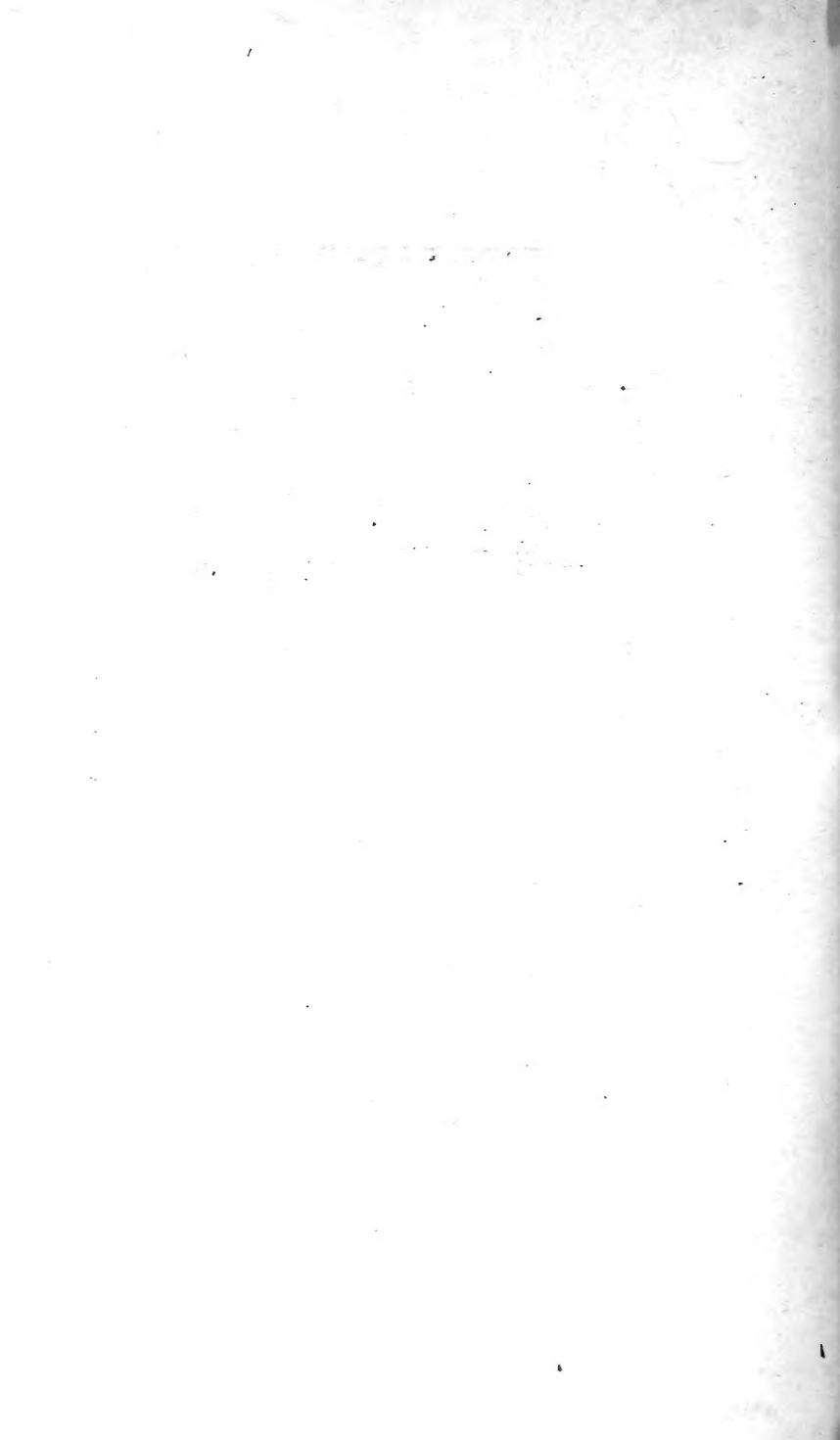
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